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AUSTRALIA

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PROVISIONAL SPECIFICATION

Applicant:

PAK TECHNOLOGIES GROUP P/L

Invention Title:

FLEXIBLE POUCH, FILLING AND HEAT SEALING LINE FOR FLEXIBLE POUCHES, AND CONTAINERS FOR SUPPORTING AND MOVING THE FLEXIBLE POUCHES

The invention is described in the following statement:

SUMMARY OF THE INVENTION

A first aspect of the invention is concerned with a pouch which facilitates easy visual inspection of the pouch by a vision system to ensure the integrity of the sealed pouch, and so that pouches which are not properly sealed can therefore be rejected.

This aspect of the invention may be said to reside in a flexible pouch including:

a front panel;

a rear panel;

the front and rear panels being joined along opposite side edges;

a gusset at the base of the panel connected to the front and rear panels for closing the base of the pouch;

an open end opposite the gusset through which a product can be loaded and which is to be closed by a heat seal which joins the front and rear panels together; and

a transparent strip on at least one of the front and rear panels which overlaps the region of the front and rear panels at which the heat seal is to be formed to facilitate inspection of the heat seal to determine the integrity of the heat seal.

The transparent strip increases the ease by which a vision system can inspect the seal to determine the integrity of the seal or determine if the seal is faulty. The transparent strip more easily allows light to be transmitted through the front and rear panels in the vicinity of the seal so that that light can then be detected to determine the integrity of the seal.

Preferably, the transparent strip is provided in the rear panel of the pouch.

Preferably, the front panel of the pouch opposite the strip is opaque and of constant colour, so if the seal is properly formed, a substantially constant amount of light will be transmitted through the front panel, the seal and the transparent strip. Thus, if the heat seal is

Preferably, the support elements each comprise a pair of spaced apart slots for receiving the side edges of the pouch, each slot having a guide entrance formed by a pair of inclined surfaces which incline outwardly from the slot and downwardly toward the slot to form a guide for guiding the edges of the pouch into the slots.

This feature enables pouches to be dropped from above the container and for the side edges of the pouches to be easily and conveniently guided into the slots so that the slots support the pouch.

Preferably, the container includes two rows of opposed slots so that the pouches are supported in pairs in the container.

Preferably, the first cooperating locater means comprises at least one a tapered pin, and the second cooperating locater means comprises at least one hole.

Preferably, the container body includes opposed side walls and opposed end walls, and a first said tapered pin is provided on a block fixed to an upper portion of one of the side walls, and a second said tapered pin is provided on a block fixed to an upper portion of the other side wall diametrically opposite the first pin.

Preferably, the container body includes a flange extending at least partway along each side wall, one of said flanges having a first said hole in vertical alignment with the first pin, and the other said flange having a second said hole in vertical alignment with the second said pin.

Preferably, the flanges extend along the entire length of the side walls.

Preferably, the slots are provided in rails which extend between the opposite ends of the container body.

Preferably, the open bottom of the container body comprises a plate, the said flanges being integral with, and part of, the plate, and at least one aperture in the plate for forming the open bottom.

Preferably, the plate includes a plurality of

the lower surface having a plurality of grooves for registering with conveyor elements to enable the pallet to be moved on a conveyor.

Preferably, the pallet body is formed from longitudinally extending and transversely extending frame elements, a plurality of beams being formed on an upper surface of the frame elements, and the tapered pin being provided on the beams.

A further aspect of the invention is concerned with the manner in which the pouches are moved through the plant after packaging of a product in the pouches and sealing of the pouches.

This aspect of the invention may be said to reside in a packaging system plant, including:

a filling and heat sealing line for filling pouches with a product and sealing the filled pouches;

a container for receiving filled and sealed pouches from the line, and for supporting a plurality of the pouches;

a transporter for receiving the containers loaded with the pouches to form a stack of the containers, and for enabling the stack of containers to be moved from one place to another;

an ancillary processing station for receiving the transporter carrying the stack of containers and for performing an ancillary treatment step on the filled pouches while housed in the stack of containers; and

a packaging station for receiving the transporter carrying the stack of containers to enable the pouches to be removed from the containers and packaged for distribution.

According to this aspect of the invention, the packages are retained in the containers as the packages are moved from the filling and heat sealing line and transported about the plant for further processing to the packaging station. This enables convenient and easy manoeuvrability of the pouches to other treatment stages

locater means of one container engaging the second cooperating locater means of the other container.

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on a transporter;

moving the stacked transporter to an ancillary processing station for performing an ancillary treatment step on the filled pouches while housed in the stack of containers; and

moving the stacked transporter to a packaging station to enable the pouches to be removed from the containers and packaged for distribution.

Preferably, the ancillary treatment stage comprises a retort for receiving the pouches.

Preferably, the retort is a shower type retort.

Preferably, the method includes locating a disperser plate on the stacked containers, the disperser plate having a plurality of holes so that in the retort hot water flows onto the disperser plate and through the plurality of holes, and then passes down through the containers and over the pouches to treat the pouches.

A further aspect of the invention relates to a container handling system for supplying containers so that pouches can be loaded into containers, and then loading the containers onto a pallet so that a plurality of loaded containers can be moved about a processing plant.

This aspect of the invention may be said to reside in a system for handling containers which are to be loaded with pouches to facilitate movement of the pouches through a processing plant, including:

a carriage for receiving an empty container;

first carriage moving means for moving the carriage from a container receiving position to a first container release position and returning the carriage to the container receiving position;

loading means for loading the container into the carriage when the carriage is in the container receiving position;

indexing means for receiving the container from the carriage at the release position and for indexing the container past a loading station at which filled and

Preferably, the second carriage includes second clamping means for engaging the container when received by the second carriage so that the container can be moved by the second carriage to the second release position.

Preferably, the loading means and the unloading means comprise a robot for performing both the loading of the empty containers into the first carriage and the unloading of filled containers from the second carriage.

Preferably, the carriages have sensors for detecting when a container is received in the first and second carriages.

Preferably, the system further includes a pallet moving conveyor for moving a pallet, from which the empty container is removed, to a stacking location, at which a filled container is deposited by the unloading means.

Preferably, the system further includes a supply conveyor for supplying pallets loaded with empty containers to the empty container unloading station, and a discharge conveyor for receiving pallets stacked with loaded containers and for transporting the stacked pallet to a discharge station.

Preferably, the pallet moving conveyor extends between the supply conveyor and the discharge conveyor, and includes a first lifting means for lifting the empty pallet above the supply conveyor so the empty pallet can be conveyed by the pallet conveyor to the stacking station, and lowering means at the stacking station for lowering the pallet onto the discharge conveyor.

A further aspect of the invention is concerned with the movement of pellets, from an unloading station at which empty containers are removed from the pallet, to a stacking station and which loaded containers are stacked on the pallets.

This aspect of the invention may be said to reside in a pallet handling apparatus for receiving pallets stacked with containers, from which the containers are to be unloaded, so the containers can be loaded with

roller conveyor at the discharge station.

Preferably, the pallet moving conveyor includes an intermediate chain conveyor section and the first transfer means comprises a first roller conveyor at the unloading station, lifting means for raising the first roller conveyor relative to the at least one supply chain conveyor so that lifting of the first roller conveyor engages the pallet and lifts the pallet above the at least one supply chain conveyor so the pallets can then move on the first roller conveyor and onto the intermediate chain conveyor, a second roller conveyor at the stacking station, lowering means connected to the second roller conveyor for lowering the second roller conveyor to lower the pallet onto the at least one discharge chain conveyor section.

Preferably, the first raising means comprises a ram and guide assembly for moving the first roller conveyor in a vertical direction between a raised and lowered position.

Preferably, the second moving means comprises at least one ram and guide assembly for moving the second roller conveyor in a vertical direction between a raised and lowered position.

Preferably, the intermediate chain conveyor includes at least one drive sprocket and a motor for driving the sprocket, and therefore the chain conveyor.

Preferably, the first and second roller conveyors have a first drive motor and a second drive motor respectively for driving at least one of the rollers of each of the first and second roller conveyors.

Preferably, the plurality of chain conveyor sections each includes a drive sprocket and at least one motor for driving each conveyor chain section.

Preferably, the discharge chain conveyor section includes a sprocket and at least one motor for driving the discharge chain conveyor section.

Preferably, the discharge roller conveyor

for circulating the chains about a continuous loop so a pallet can be moved on the section, and wherein the first pallet transfer means includes a subassembly mounted to the chain conveyor section, the subassembly carrying a first roller conveyor formed of a plurality of rollers, means for raising and lowering the subassembly and first roller conveyor relative to the chain conveyor section so that when a pallet is on the chain conveyor section at the unloading station, the subassembly can be raised to engage the pallet and lift the pallet above the chains of the chain conveyor section so the pallet can then be moved on the first roller conveyor in a direction transverse to the direction of movement on the chain conveyor section, and wherein the moving means is for lowering the subassembly so the roller conveyor is moved below the chains of the chain conveyor section to allow another pallet to move along the chain conveyor section; and

the discharge conveyor including a discharge conveyor chain section which defines the stacking station, the discharge chain conveyor section including a pair of chains for moving a pallet on the discharge chain conveyor section, a second subassembly mounted to the discharge chain conveyor section, and including a second roller conveyor, second moving means for raising the second subassembly and the second roller conveyor relative to the discharge chain conveyor section so that in a raised position of the subassembly and the second roller conveyor, the pallet is able to move along the pallet moving conveyor and onto the second roller conveyor, the second moving means also being for lowering the second roller conveyor to deposit the pallet on the chains of the discharge chain conveyor section; and

the first subassembly, the first roller conveyor and the second subassembly and the second roller conveyor forming part of said pallet moving conveyor so that a pallet can be rolled from the first conveyor section along the pallet moving conveyor to the second roller conveyor.

(a) a back light for producing light so that light is transmitted through the sealed pouch in the vicinity of a heat seal produced by the heat sealing station;

(b) at least one camera for receiving light which is being transmitted through the pouch in the vicinity of the seal;

(c) processing means for determining from the light received by the camera the integrity of the seal to determine whether the pouch should or should not be rejected.

Thus, as the pouches are filled and heat sealed, the pouches can then be monitored to determine the integrity of the seal, and if the seal is not properly formed, the pouch can be rejected before the pouch is moved for further processing and packaging into boxes.

Preferably, the pouch includes a transparent strip which overlaps the heat seal to facilitate transmission of light through the region of the pouch in the vicinity of the heat seal to in turn facilitate determination of whether the seal has been properly formed.

Preferably, the processing means compares the light received by the cameras with a grey scale to provide an indication of whether the seal is properly formed.

Preferably, the system includes a reject station which is activated by the processing means if a seal is determined to be inadequate so the pouch is rejected from the line at the reject station.

Preferably, the reject station comprises a moveable door over which the pouches pass and which is open to enable the pouches to drop through the door.

Preferably, the processing means is for determining whether pixels of the at least one camera see light intensity on a grey scale above a predetermined grey scale value, and also determines whether a second predetermined number of adjacent pixels have a grey scale

Figure 12 is an underneath view of the pallet of Figure 11;

Figure 13 is a plan view of containers, according to Figures 2 and 3, stacked on the pallet of Figures 11 and 12;

Figure 14 is a perspective view of a stacked pallet according to Figure 13;

Figure 15 is a plan view of a filling and heat sealing line and pouch handling system according to the preferred embodiment of the invention;

Figure 16 is a view of a trolley and support for loading and unloading pallets onto the system of Figure 15;

Figure 17 is a perspective view of the support shown in Figure 16;

Figure 18 is a detailed view showing the support in an unlocked position;

Figure 19 is a view of the support in a locked position;

Figure 20 is a perspective view of a trolley shown in Figure 16;

Figure 21 is a view of part of the trolley of Figure 20 showing a locking mechanism;

Figure 22 is a perspective view of the locking mechanism of Figure 21;

Figure 23 is a plan view of part of the filling and heat sealing line shown in Figure 15;

Figure 24 is a side view of part of the filling and heat sealing line shown in Figure 15;

Figure 25 is a plan view of part of the mechanism shown in Figure 24;

Figure 25a is a cross sectional view along the line Z-Z of Figure 25 in a retracted position;

Figure 25b is a cross sectional view similar to Figure 25a but in an extended position;

Figure 26 is a side view of the mechanism shown in Figure 24;

preferred embodiment;

Figures 44, 45 and 46 are a detailed view of the supply conveyor shown in Figure 43;

Figures 47 and 48 are diagrams showing the releasable retaining of a pallet on the supply conveyor;

Figure 49 is a view of part of the supply conveyor and the pallet moving conveyor in direction of line Y-Y in Figure 15;

Figure 50 is a view of the pallet moving conveyor taken from the line Y-Y of Figure 15;

Figure 51 is a view taken from the line Y-Y of part of the moving conveyor.

Figure 52 is a side view also along the line X-X of part of the discharge conveyor of Figure 15;

Figure 53 is a plan view of the part of the conveyor shown in Figure 33; and

Figure 54 is a block diagram of a controller and sensor arrangement used in the preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference to Figure 1, a front view of a flexible pouch, also called a doy pouch or pillow pouch, is shown. The pouch 1 has a front panel 3 and an opposite rear panel 5. The panels 3 and 5 are coupled together along the opposite edges 7 and 9 by heat sealing the panels together or by any other suitable method of connecting the panels 7 and 9 along their opposed edges. A gusset 11 is provided in the base of the pouch and is also joined to the front and back panels 3 and 5. The panels 3 and 5 and the gusset 11 may be formed from a single piece of material, or alternatively, can be formed from three separate pieces of material. The above described pouch structure is known and therefore does not need to be defined in any further detail.

The pouch may be provided in different sizes, and in particular, in different lengths, as illustrated by the

strip 13 is of uniform colour so that light of uniform intensity will pass through the transparent strip 13 and the opposite portion of the front panel 5 for detection by the vision system. The vision system therefore is able to inspect the seal 17 and determine whether any particular matter has become located in the seal 17 which will impair the integrity of the seal, and therefore result in spoiling of the product contained within the pouch 1. The transparent seal 13 therefore facilitates visual inspection of the package by the vision system for monitoring the integrity of the seal 17.

Figures 2 to 5 are views of a container for receiving and supporting a plurality of the pouches of the type described with reference to Figure 1. The container comprises a container body 25 formed from side walls 27 and 29, and end walls 31 and 33. As is shown in Figure 3, the bottom of the container 25 is provided with a base plate 35 which has a plurality of rectangular apertures 37 which form an open bottom. The top of the container 25 is open, as shown in the plan view of Figure 2, except for guide rails 39 and 41, so that water is able to flow down through the open top of the container 25, over the pouches supported in the container 25 and out through the apertures 37 in the base plate 35.

The base plate 35 extends beyond the side walls 29 to form flanges 43 which are part of and integral with the base plate 35.

A block 44 is connected in the top corner of the wall 29 and an identical block 45 is connected in the top diametrically opposite corner of the wall 27. The blocks 44 and 45 carry a tapered pin head 46 which form a first cooperating locating element for enabling a number of the containers to be stacked one above the other and locked in position relative to one another.

As best shown in Figures 3 and 9, the flanges 43 have circular holes 47 which are arranged directly below the pins 46 and which form second cooperating locating

7 and 9 do not directly fall into the slots 50, the side edges will contact the sloping surfaces 51 or 53 and be guided into the slot 50 so that the side edges pass into the slot 50 until the bottom of the pouch 1 contacts base plate 35 of the container 25.

Figure 7 is a cross sectional view showing relatively long pouches 1 supported in the container 25 with the base of the pouches resting on base plate 35. If the pouches are shorter pouches, as shown in Figure 6, insert trays 55 are provided. The trays 55 are best shown in Figure 8 and comprise a generally U-shaped channel section having side flanges 57 and 59 and upper wall 60. The upper wall 60 is provided with apertures 61 which generally match the size and shape of the apertures 37 in the base plate 35. The trays 55 are located in the containers, as shown in Figure 6, to provide a platform on which the base of the shorter pouches 1', shown in Figure 6, can rest to ensure that edges 7 and 9 of the pouches are engaged in the slots 50 of the rails 39 and 43 so that pouches 1' are properly supported in the container 25.

Figures 11 and 12 show a pallet 62 upon which the containers 25 can be stacked. The pallet 62 comprises longitudinal frame members 63 and transverse frame members 65.

Four beams 67 are connected onto the frame member 63 and 65 and carry tapered pin heads 69, which are identical to the pin heads 46 previously described, and which are located so that when an initial layer of containers 25 is stacked on the pallet 62, two of the pins 69 will locate in the holes 47 in the flanges 43 of the containers 25 to securely locate the container 25 in position on the pellet 62. In the preferred embodiment of the invention, the pallet 62 is designed to carry an initial layer of 3 x 3 containers 25.

One of the end frame members 65 is provided with a pair of sleeves 71 which are intended to receive a handle (not shown) which can be connected to the sleeves

pouches.

The peripheral frame 79 may be provided with openings 83 which are provided to register with pins 46 on the containers 25 in the uppermost layer of containers 25 stacked on the pallet 62 to securely locate the diffuser plate 77 in place on the stacked containers 25.

Figure 15 is a plan view of the filling and heat sealing line together with the pouch handling system according to the preferred embodiment of the invention. The filling and heat sealing line comprises a filling station 90, a heat sealing station 92, a cooling station 94, a pressing station 96, a vision system 98, a reject station 100 and a pouch loading station 102. The filling station, heat sealing station, cooling station and pressing station are all of conventional design and therefore will not be defined in any detail hereinafter. Suffice it to say that pouches are filled with a product at the station 90, the pouches are then sealed to form the heat seal 17, shown in Figure 1, at station 92, the heat seal region is cooled at station 94, and the pouches are then squeezed at station 96 so that the contents of the pouch is evenly distributed throughout the pouch.

The pouch is then passed through the vision system 98 where the pouches are monitored for seal integrity and if the seal is regarded as faulty, the pouches are ejected at reject station 100. If the pouches are properly sealed, they pass to pouch loading station 102 where the pouches drop into containers 25.

The system includes a supply conveyor 104 and a discharge conveyor 106. Pallets 62 are loaded onto the supply conveyor 104 and conveyed by the supply conveyor 104 from pallet receiving end 104′ to unloading station 104′′. The empty containers supported on pallet 62′ at the unloading station are unloaded from the pallet 62′ by robot 105. The robot 105 is conventional in design, except for the head which engages the containers 25, and therefore will not be described in detail. The head of

treated, and water from the retort is able to flow through the open top of the containers 25, over the pouches and out through the open bottom so the water flows down through the stack of containers and over all of the pouches to properly treat the pouches. After the product in the pouches 1 has been sterilised in the retort 112, the pallet 62 is removed from the retort 112 and moved to a packaging station 114 where the pouches are removed from the containers 25 and packed in cardboard boxes for distribution. Thus, this embodiment of the invention enables the pouches to be conveniently and easily handled after the pouches are filled and sealed so that the pouches can be further treated in the retort 112 and then moved to the packaging station for packaging.

Figure 16 shows receiving end 104' of the supply conveyor 104. A trolley support 116 is fixed to the floor at the end of the conveyor 104 so the trolley 120 can be rolled up the support 116 and located at the end of the conveyor 104 so the pallet can be moved from the trolley and onto the conveyor 104. As is best shown in Figures 16 and 20, the trolley 120 comprises box section wheel supports 121 from which wheels 123 are suspended by brackets 123a. The box section supports 112 also support cross frame members 122 and 124 and longitudinal roller guides 125. As best shown in Figure 20, the guides 125 comprise a first beam 127 and a second beam 129 between which rollers 131 are journalled on axles 133.

The frame member 122 carries a plate 139 which has an opening 141. As is most clearly seen in Figure 22, a catch 143 passes through the opening 149 and is pivotally mounted between blocks 144 fixed to the plate 139 on pin 145. One end of the catch 143 is biased downwardly by spring 147 which is connected between the catch 143 and lug 149 fixed to the plate 139. The other end of the catch 143 has an abutment surface 150. The catch 143 also has an unlocking lever 152 fixed to the end of the catch 143 which is connected to spring 147.

supported on legs 146 which are designed to ensure that the trolley 120, when loaded onto the support 116, is at the height of the conveyor 104 (or the conveyor 106) as previously described. The support 116 includes a wheel lock 148 for securely holding the trolley 120 on the support 116 during unloading of a pallet from the trolley 120 (and reloading of the pallet from conveyor 106 onto the trolley). As best shown in Figure 18, the wheel lock 148 comprises a bar 149 which passes beneath the tracks 141 and 142 in guide sleeves 150. The bar 149 carries an L-shaped lug 153 and an L-shaped lug 154. The lug 154 has an upstanding handle connected to it to facilitate movement of the bar 149 in the direction of double headed arrow C in Figure 18. As can best be seen in Figure 18, the channels 141 and 142 have side walls 155, and the side walls 155 are provided with cut outs 157 in the vicinity of the L-shaped lugs 153 and 154. When a trolley 120 is rolled up onto the support 116, as is shown in Figure 18, the bar 149 is pulled all the way to the right in Figure 18 so that the lugs 153 and 154 are clear of the channels 141 and 142 to enable the wheel 123 to be moved all the way to the end of the channels 141 and 142. The bar 149 is then pushed to the left in Figure 18 so the bar slides in the sleeves 150 and the L-shaped lugs 157 pass through the cut outs 157, as is shown in Figure 19, and locate behind the front wheels 123 of the trolley 120. Thus, the trolley 120 is securely locked in place at the end of the conveyor 104 to facilitate movement of a pallet from the trolley 120 onto the conveyor 104. The trolley is unlocked simply by moving the bar 149 to the right in Figure 18 so the L-shaped lugs 153 and 154 are moved away from the wheels 121, and the trolley can be rolled on the channels 141 and 142, and off the support 116. A support identical to the support 116 is also located at the end of the conveyor 106 for locating a trolley 120 onto which stacked pallets 62 are to be loaded after the pellets are conveyed from the station 106'' to the ends 106' of the

pin 215. Retracted by the cylinder 210, the plate 213 pivots in the direction of Arrow D which pulls the bar 201 in the direction of Arrow E so that it overlaps the plate 213. This movement will withdraw the fingers 202 away from the pouches 1 which are supported on a guide surface 215 (see Figure 23) on which the pouches 1 can slide as the pouches are moved by the mechanism 200. When the ram arm 211 is extended, the plate 213 pivots in the direction opposite Arrow D to push the bar 201 in the direction opposite Arrow E so the fingers 202 can engage a pair of pouches 1 with the pouches 1 being located between the fingers, as shown in Figure 25.

The plate 203 is connected to a chain conveyor which is driven by a sprocket and servo motor so that the entire mechanism shown in Figures 25 and 26 can be moved in the direction of Arrow F and then back in the direction of Arrow G. The sprocket and servo motor arrangement which drives the plate 203 back and forward in the direction of Arrows F and G is the same as the mechanism to be described with reference to Figure 37 which moves the carriage 400 in reciprocating fashion. This reciprocating movement of the bar 201 and the inward and outward movement of the bar 201 in the direction of Arrow E and the direction opposite Arrow E, will cause the bar to index the pouches 1 along the line towards the loading station 102 shown in Figure 15. That is, the sequence of operation of the mechanism 200 is that the chain conveyor will index the entire mechanism in the direction of Arrow G a distance equivalent to a multiple of the space between the finger 202′ and 202′′ in Figure 25. This movement will cause the pouches 1 retained within the spaces S1 to be moved in the direction of Arrow G by that distance. After that initial movement, the ram arm 210 is retracted so as to pull the bar 201 and the fingers 202 in the direction of Arrow E so they disengage from the pouches 1. The chain conveyor and stepper motor then moves the entire mechanism 200 in the direction of Arrow F so the pouches 1

the pouches are indexed by movement of the bar 201 in the manner previously described.

As previously described, and as shown in more detail with reference to Figures 24 and 27, the loading station 102 is arranged above indexing mechanism 106. Pouches 1'' in Figure 26 are shown at the loading station 102. The loading station 102 is the same as the reject station 100 and comprises doors 227 which are opened in sequence with the arrival of the pouches 1'' at the station 102. The pouches 1'' are therefore able to drop by gravity through the open doors 227 and into the containers 25 (not shown) which are being indexed by the mechanism 106 in the direction of Arrow H in Figure 27 past the loading station 102.

With reference to Figures 27 to 31, which show the indexing mechanism 106 in more detail, the mechanism comprises a pair of continuous chains 240 which are interconnected by abutment bars 241. The bars 241 are carried by the chains 240 as the chains circulate about sprockets 242 shown in Figure 29. Sprocket 242, at the right hand of Figure 29, is driven by stepper motor 243 so that the chain moves in indexing fashion in a direction of Arrow J in Figure 29.

With reference to Figure 29, a container labelled 25' is positioned in a carriage 400 (see Figure 32) by robot 105 which lifts the empty container 25' from pallet 62' shown in Figure 15, and deposits the container 25' in the carriage which is located at the right hand end of the indexing mechanism 106. The carriage includes a pair of clamps, schematically shown at 250 in Figure 29, which hold the container 25' so the container is moved with the carriage and is able to slide on tracks 252. The movement of the carriage in the direction of Arrow K is an indexing movement which is synchronised with the indexing movement of the chains 240. The carriage moves the container 25' to a drop station 255 at which the container 25'' is located. At that station, the clamps 250 are released so

same as the previously mentioned carriage, is located at the station 260 and the container 25''' is pushed up into that carriage. The receiving carriage includes clamps similar to the clamps 250 and those clamps engage the container 25''' after it has been lifted by the ram 261 so that the container 25''' is securely held in the carriage 402. The ram 261 is then lowered to return the plate 262 to the position shown in Figure 29. The receiving carriage then moves the container 25 to a collection station 270 which is occupied by the container 25'''' shown in Figure 29. After the container 25''' has been engaged by the receiving carriage and commences to move, the container 25'''' slides on guide rails 263. When the container reaches the station 270, the clamps of the receiving carriage are released, and the robot 105 engages that container and moves the container from the receiving carriage and stacks it on a pallet at the stacking station 106'' shown in Figure 15. Thus, the loaded containers are stacked on a pallet (such as the pallet 62a shown in Figure 15) and when the pallet is full, the pallet 62a is moved to end 106' of the discharge conveyor 106 shown in Figure 15 in the manner previously described.

Figures 32 to 38 show more detail of the indexing mechanism 106, and in particular, the carriages 402. With reference to those figures, and in particular Figures 32 and 36, the carriage 400 has a rear wall portion 403 and side wall portions 404 and 405 so the carriage forms a square U-shaped configuration. Figure 36 omits much of the wall structure 403, 404 and 405, so the clamps 250, which are contained within the wall structures 404 and 405, can be clearly seen. As shown in Figure 36, the carriage has a pair of flanges 407 which have U-shaped channels 408 and which receive rails 409 of a linear bearing 410. The linear bearing 410 is completed by a rail 411 on which the rail 409 sits. The flange 407, on the right of Figure 36, has an extending plate 412 which carries clamp plates 413 and 414 which are clamped onto a

labelled 25a, between two of the bars 241 carried by the chain 240. The container 25a is then continued to be indexed by the chain 240 past the loading station 102, previously described. The motor 440 then reverses direction and quickly moves the carriage 400 back in the direction opposite Arrow S to the position shown in Figure 32, ready to receive another container 25 from the robot 105.

As previously described, the container 25 is indexed by the belt 240 and the bars 241 to the collection station where the carriage 402 collects the container 25, as is shown in Figure 34. As previously described, the ram 261 is activated to raise the container 25 up into the carriage 402 which is ready waiting in the position shown in Figure 34 in registry with the ram 261, and plate 262. When the container 25 is received in the carriage 402, the clamps 250 of the carriage 402 are operated to engage the container 25 so the ram 261 can be retracted, and then the carriage 402 is moved from the position shown in Figure 34 to the position shown in Figure 35 by a belt 415 and motor 440, which are exactly the same as the assembly previously described, and which is shown in Figure 38.

When the container 25 has been moved to the position shown in Figure 35, the container 25 is ready for stacking by the robot 105 and once the container 25 is removed from the carriage 402, the carriage 402 moves back to the position shown in Figure 34 ready to receive the next container 25 when the container 25 reaches the ram 261 and the plate 262.

The carriages 400 and 402 may include sensors for detecting when a container 25 is loaded in the carriage to provide a signal indicative of the presence of a container to facilitate sequence of movement of the carriages 400 and 402 in the indexing mechanism 106.

Figure 39 shows the sequence of movement of the robot 105. As can be seen in Figure 39, the robot lifts a container 25 from the unloading station 104 on the

only the doors 227 and their mode of operation need be described.

As shown in Figure 41, the doors 227 are pivoted on pivot pins 460 and 461 to part of the filling line frame (not shown). A pneumatic ram 462 is provided and has a ram arm 463 which is pivotally connected to an upstanding link 464. The link 464 is connected to a link 465 by pivot pins 466 and to one of the doors 227 by pivot pin 466. As shown in Figure 41, the link 465 connects to the upstanding link 464 at a mid portion of that link. The upper portion of link 464 is pivotally connected to a link 470 by a pivot pin 471. The other end of the link 470 is pivotally connected to the other door 227 by pivot pin 472.

When the arm 463 is retracted, as shown in Figure 41, the doors 227 are closed and a pouch 1 is able to rest above flange portions 480 of the doors 227. When the ram 462 is activated to extend the ram arm 463, the links 464, 465 and 470 pivot into the position shown in Figure 42 which causes the doors 227 to pivot downwardly, as shown in Figure 42, so that the flanges 480 are removed from beneath the pouch 1 and the pouch is able to drop under the influence of gravity through the doors 227. It is then deposited in one of the containers, as previously described. The ram arm 463 is then retracted to close the door 227 to await the next pouch and an appropriate signal from the indexing mechanism and system controller to again open the doors 227 to allow that pouch to drop into the next pair of slots 50 of a container 25.

Figure 43 is a side view of the supply conveyor shown in Figure 15 in the direction of Arrow X in that figure. The conveyor 104 includes a first chain conveyor section 270, a second identical chain conveyor section 271, and a third chain conveyor section 272 which forms the unloading station 104''. The section 272 also carries a subassembly 273 which in turn supports a roller conveyor which forms part of the pallet moving conveyor 110 shown

pivot pin 288 into the retracted position shown in Figure 48. When the pallet 62 has moved onto the conveyor section 272 and abutted against abutment 286, the ram arm 287 is retracted to pivot the finger 287 in the direction of Arrow L in Figure 48 so as to position the finger in the position shown in Figure 36 at which it engages the opposite end of the pallet to securely hold the pallet as previously described.

The chain conveyor section 272 which forms the unloading station 104'' also carries the subassembly, 273 previously described. The subassembly 273 is also shown in Figure 38. It should be understood that the conveyor section 272 is shown from the direction of Arrows X in Figure 15, in Figure 44, and from the direction of Arrows Y in Figure 15, in Figure 49. The chain 280 and its associated sprockets etc, are not fully shown in Figure 49 for ease of illustration, although Figure 49 does show parts of the chain 280 located in the groove 73, the pallet 62.

The subassembly 273 comprises opposite frame sections 290 (only one of which is shown) and only one of which can be seen in Figure 44 for ease of illustration. Each frame section 290 is joined by a cross frame member, and each frame section 290 journals one end of a plurality of axles 291.

The frame sections 290 sit on curved frame supports 293 which form part of the frame 275 of the conveyor section 272. A ram 294 is fixed to the frame 275 and has a ram arm 295. The ram arm 95 is connected to a bar 296 by a pivot connection 297. The bar 296 is connected to a pair of cross bars 299 (only one shown in Figure 44) for pivotal movement relative to the bar 296. The bars 299 each carry a pivotally mounted lever 300. Each lever 300 is connected to a bar 301 and the bars 301 each carry at their ends lever arms 302.

Thus, when the ram arm 295 is moved in the direction of Arrow N in Figure 49, the bar 296 is moved in

engagement with the pallet 62, the pallet is driven along the rollers which forms part of the pallet moving conveyor 110, previously described with reference to Figure 15.

Figure 50 is a view of the pallet moving conveyor 110 from the direction of Arrows Y in Figure 15.

The moving conveyor 110 comprises the section 272, previously described, and in particular, the subassembly 273 which carries the roller conveyor previously described, a central conveyor section 320, and a second conveyor section 272' which is identical in structure to the conveyor section 272. The section 272' forms the stacking station 106'' of the discharge conveyor 106. The second 272, in terms of the subassembly 273, is structured exactly the same as the subassembly in the section 272 except that in this embodiment the subassembly 273 is initially held in the raised position so that a pallet 62, which has been driven off the section 272 and onto the section 320, can then be driven onto the section 273 by the rollers 305. Until the pallet abuts end abutment 321. At this stage, the ram 294 is activated to lower the subassembly 273 and therefore the roller conveyor formed by the roller 305, so that the pallet 62 is lowered onto the chains of the conveyor section 272' so those chains register in the grooves 73 on the underneath side of the pallet 62. The pallet 62 is locked in position on the section 272' by fingers 287, identical to those previously described, so the pallet is securely and accurately located on the section 272' so that loaded containers 25 can then be stacked on the pallet 62. After the pallet has been stacked, the loaded pallet 62 can be moved on the chains of the section 272' and along the conveyor 106 to discharge end 106' as has been previously described. Thus, the section 272' forms part of the pallet moving conveyor 110 and also part of the discharge conveyor 106.

The mid section 320 of the moving conveyor 110 is shown in more detail in Figure 51 and includes sprockets

pouches from the back light 225, as is previously explained. The seal region of the pouches 1 is identified by using the notches 21, previously described, which form a reference point. Thus, the control software which may be fully contained within the cameras 230 themselves, or which may be separate from the cameras, locate the notches 21 and when found, have positioned the transparent strip 17 because the transparent strip 17 will always be located in a fixed position relative to the notches 21. Thus, the inspection region of interest is therefore identified and now can be processed to determine whether the seal is properly formed.

The control software compares the intensity of light received by each pixel in the inspection area of the camera with a grey scale which runs from 0 which is indicative of white light to 255, indicative of no light at all, or in other words "black light". If the seal is properly formed, the intensity of the light detected by the pixels of the cameras 230 should be on the grey scale range of between 0 and, for example, 130. If the pixel identifies an intensity on the grey scale of above, for example, 150, this is indicative of some contaminant or other imperfection in the heat seal.

The next step in the software routine is to determine the size of the contaminant, and this is done by a blob extraction routine which determines the number of adjacent pixels which have a grey scale value of above 150. If only scattered single pixels have a grey scale value above 150, then this can be taken to indicate that there is no problem with the heat seal and the pouch is properly formed. However, if a number of adjacent pixels, for example 50 pixels, produce a grey scale value above 150, this is indicative of a contaminant of significant size being located in the heat seal which has destroyed the integrity of the heat seal, and therefore may allow air to enter the pouch, which would destroy the contents of the pouch. Thus, the grey scale reading for a number

Sensors 508 and 509 are associated with the clamp cylinders 290 of the sections 272 and 272' for determining whether those cylinders are extended or retracted, and thereby to determine whether the pallet 62 is clamped in position or available for movement. The motors to transfer a pallet 62 from those sections is therefore not operated until the cylinder is retracted and the finger 287 removed away from the pallet so the pallet can be moved. Sensors 510 and 511 are associated with the rams 294 associated with the sections 272 and 272' to determine whether the roller conveyor 305 is in the raised or lowered position ready to transfer a pallet to the pallet moving section 320, and then to the section 272' of the discharge conveyor 106. Sensor 512 is associated with a robot 105 and determines whether a container 25 is gripped and held by the head 105a of the robot. Sensor 513 is the sensor which is associated with the carriage 400 for determining whether the container has been deposited in the carriage, and sensor 514 is associated with the clamps 250 of the carriage 240 for determining whether those clamps are in the clamping position or release position.

Sensors 515 and 516 are associated with the loading station 102 and determine when pouches fall through the doors 227 and into the container 25.

Sensor 517 determines the position of the lifting ram 261 and the plate 262 and the sensor 518 is associated with the clamps 250 and the carriage 402 for determining whether those clamps are in the clamping position or the release position. Sensors 519, 520 and 521 are associated with the carriage 400 and determine the home position of the carriage and whether the carriage has over travelled or under travelled during movement of the carriage from the position at which the carriage receives the container 25 to the position at which the carriage releases the container 25 to the indexing chain 240.

Sensor 522 is associated with the indexing chain 240 and is used to determine the home position of the

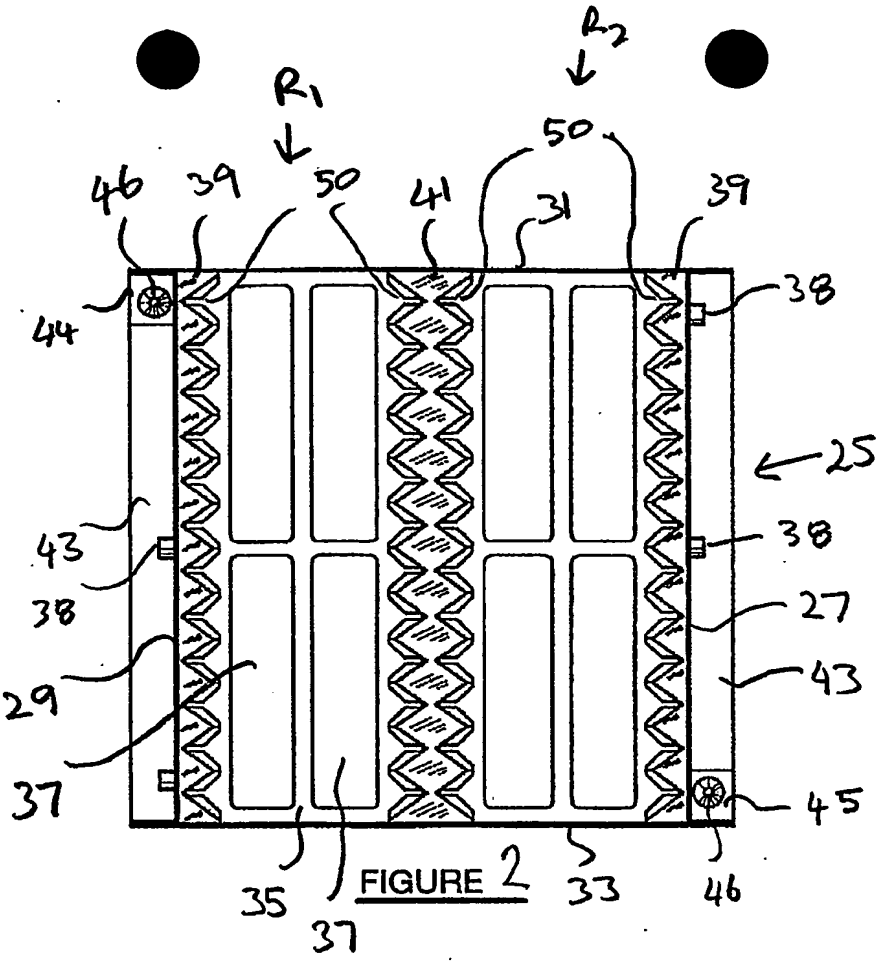

FIGURE 2

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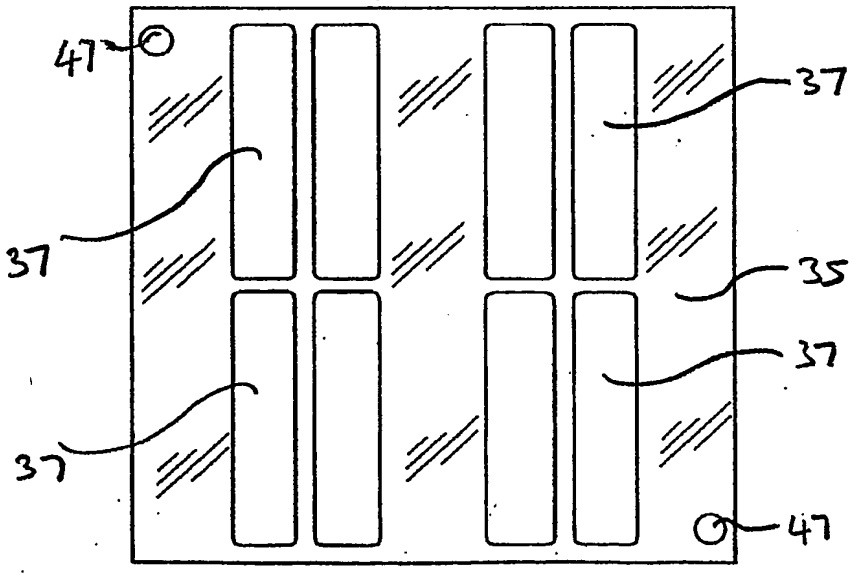

FIGURE 3

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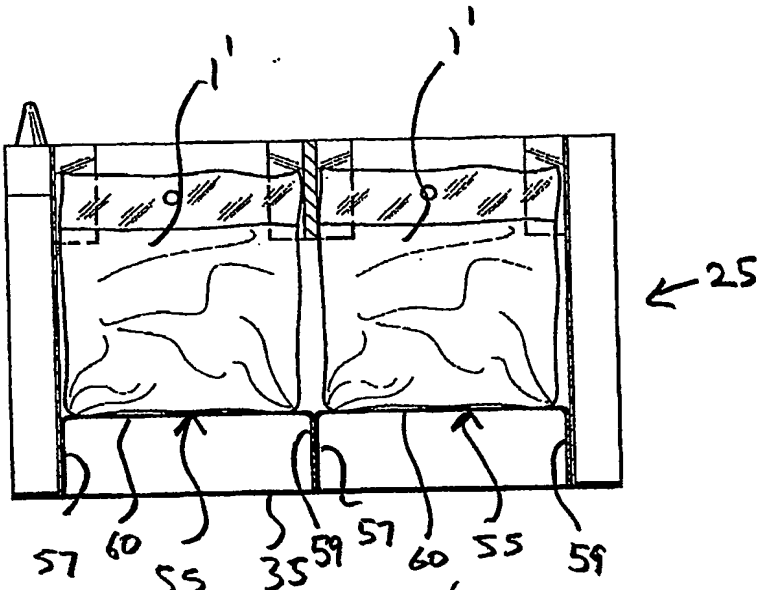


FIGURE 6

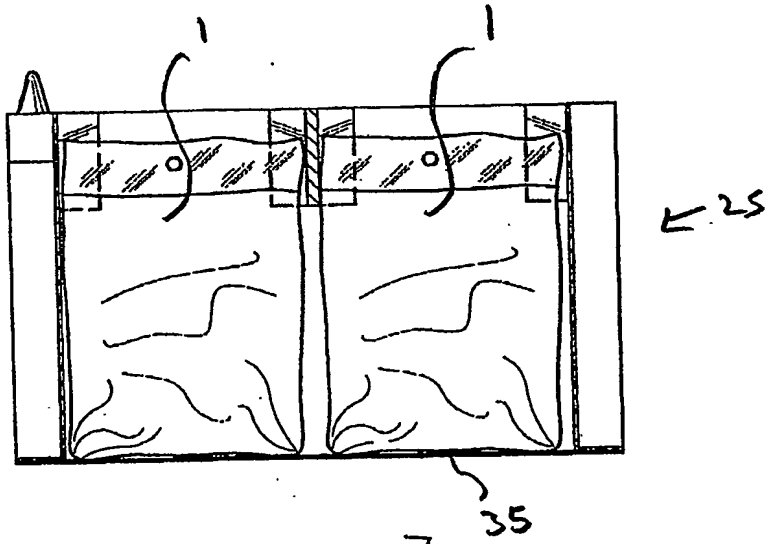


FIGURE 7

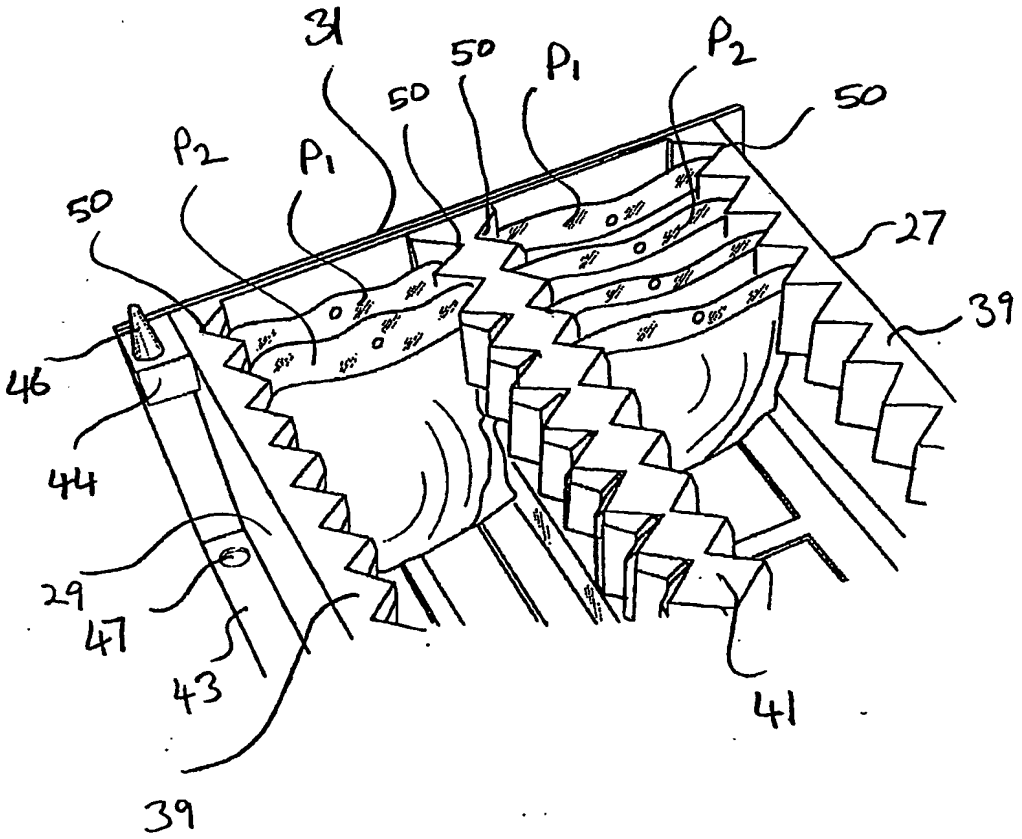


FIGURE 9

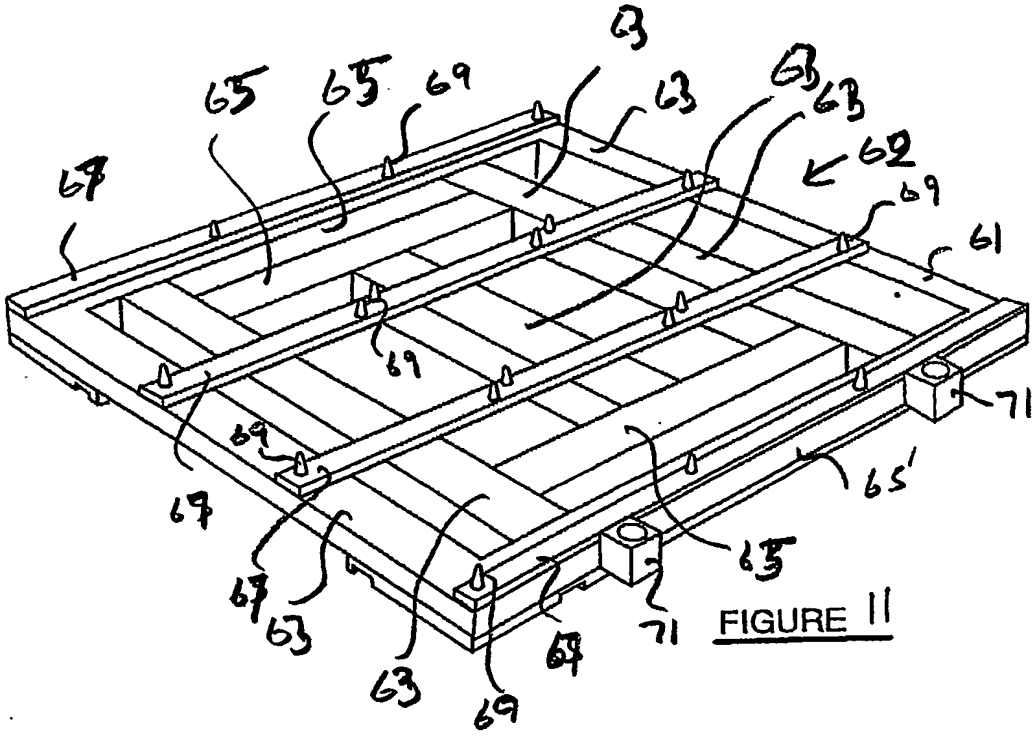


FIGURE 11

11

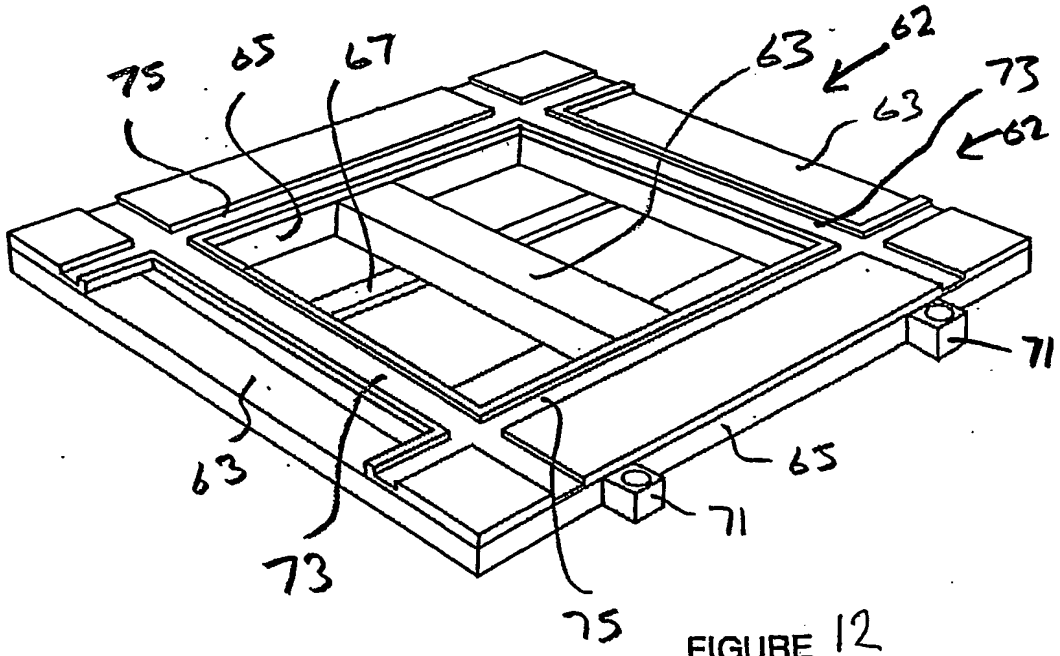


FIGURE 12

12

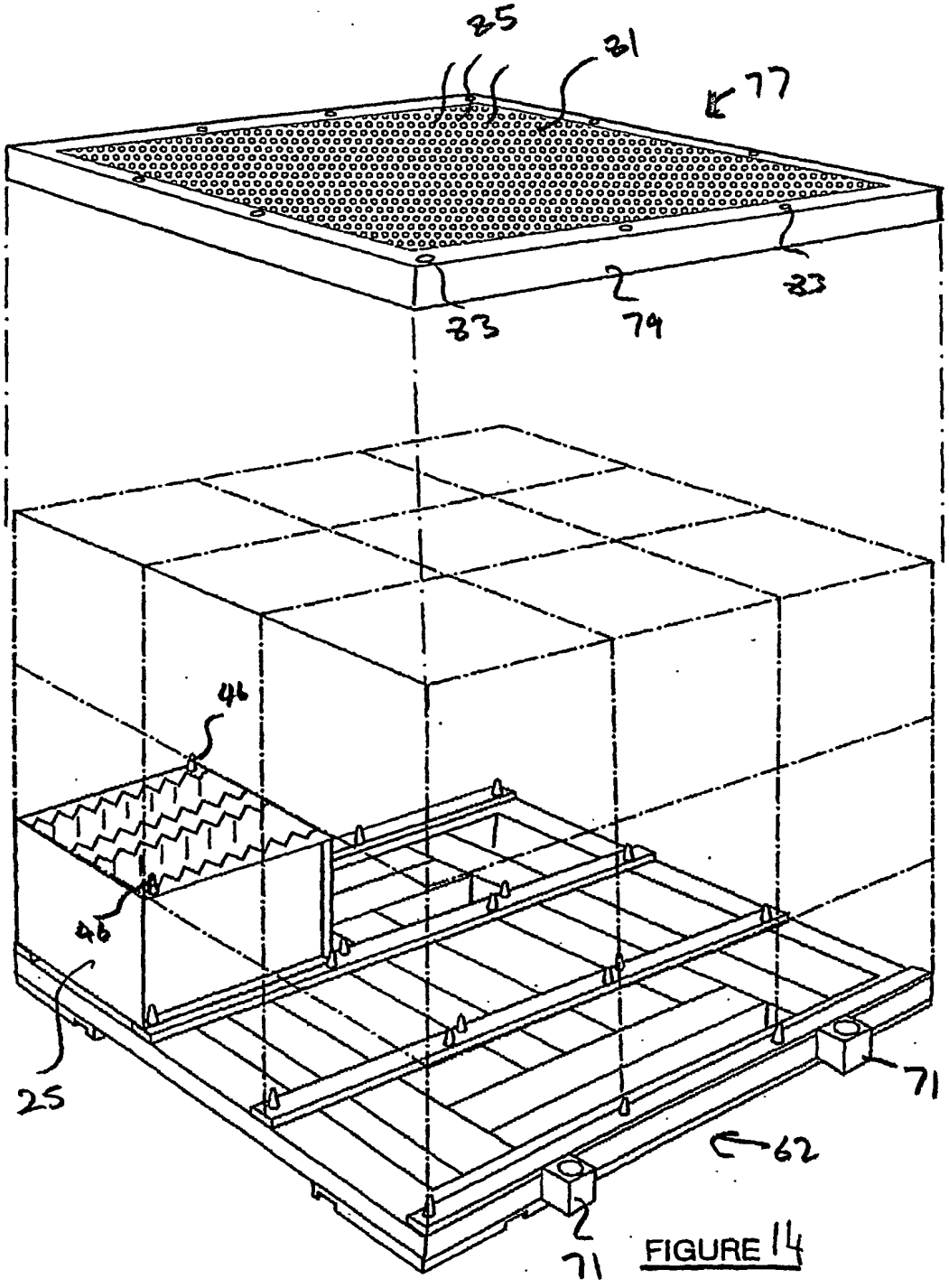


FIGURE 14

14

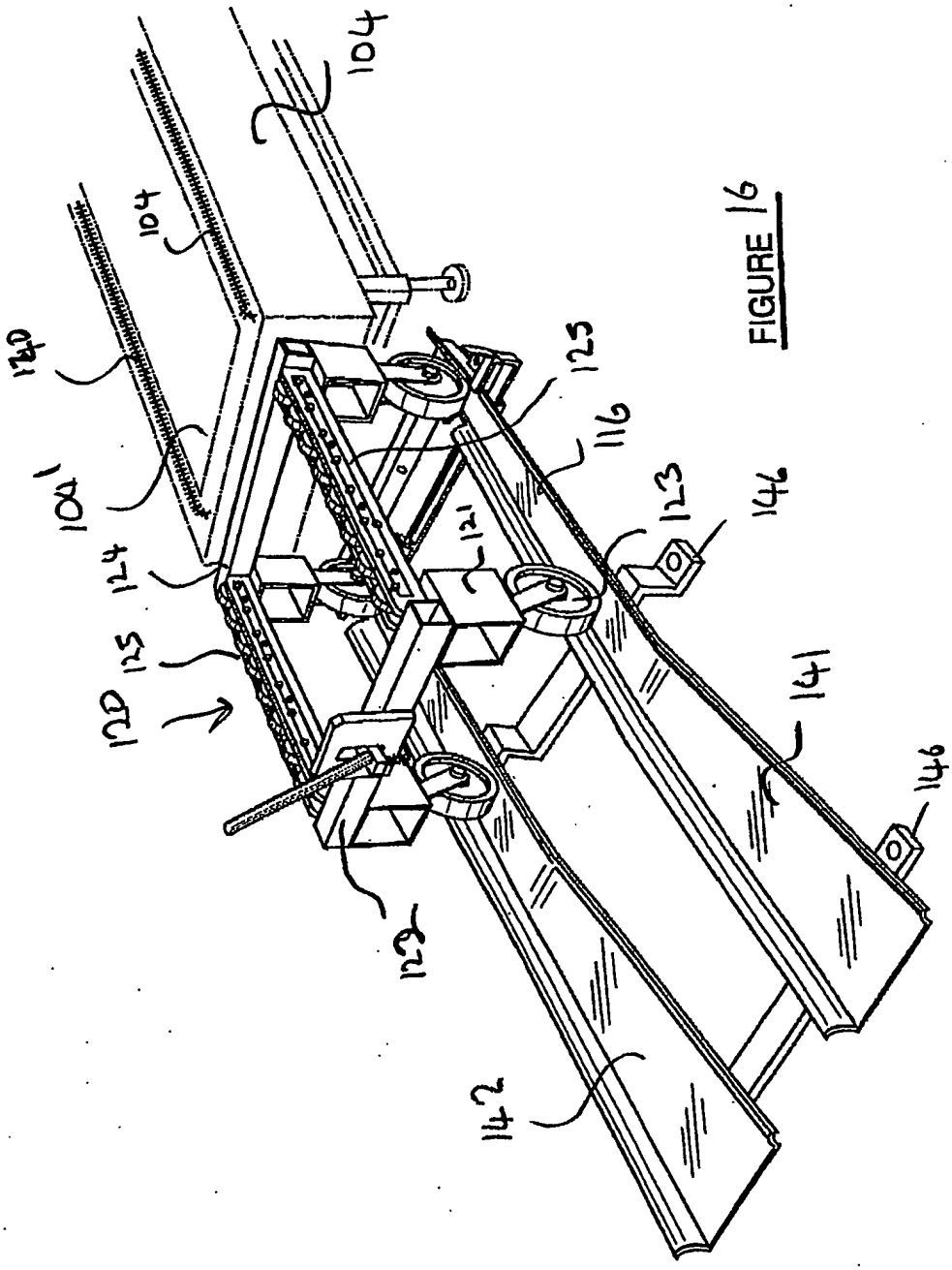
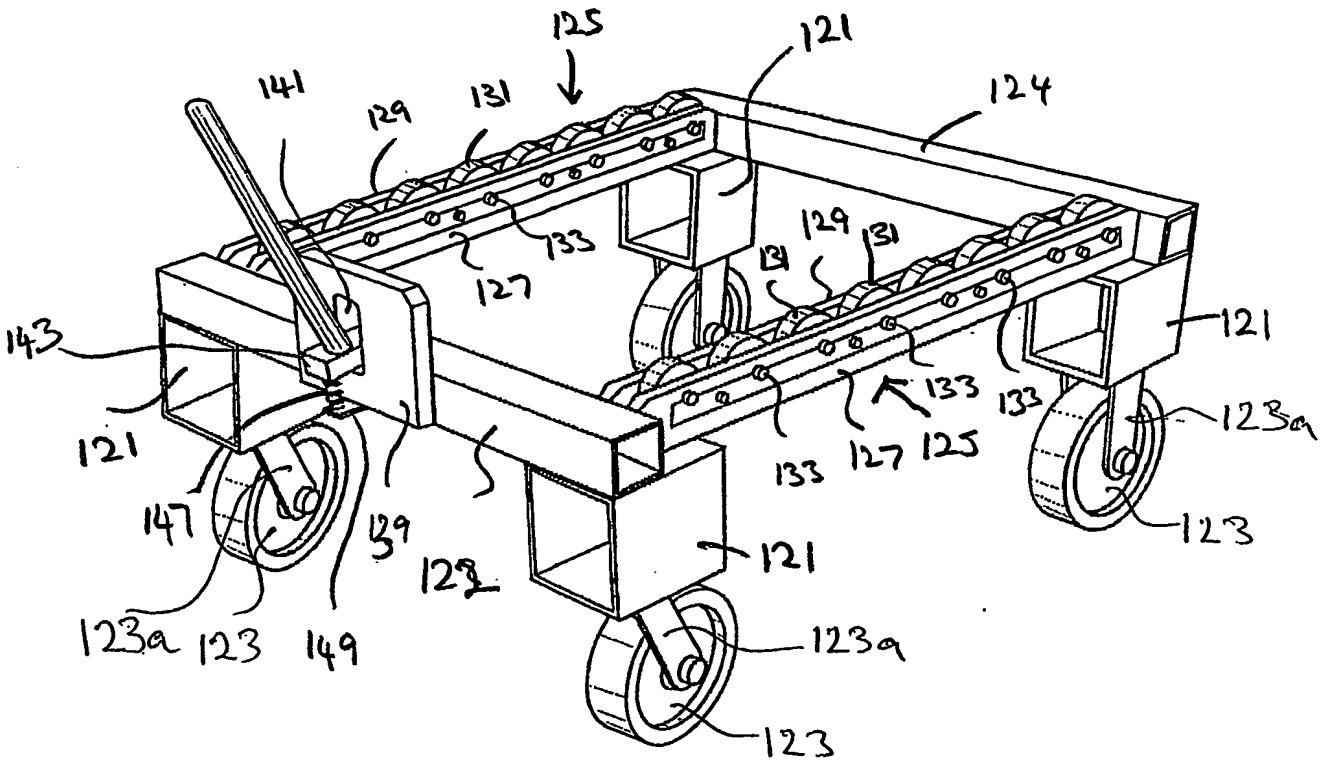


FIGURE 16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124
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127
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131
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143
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123a
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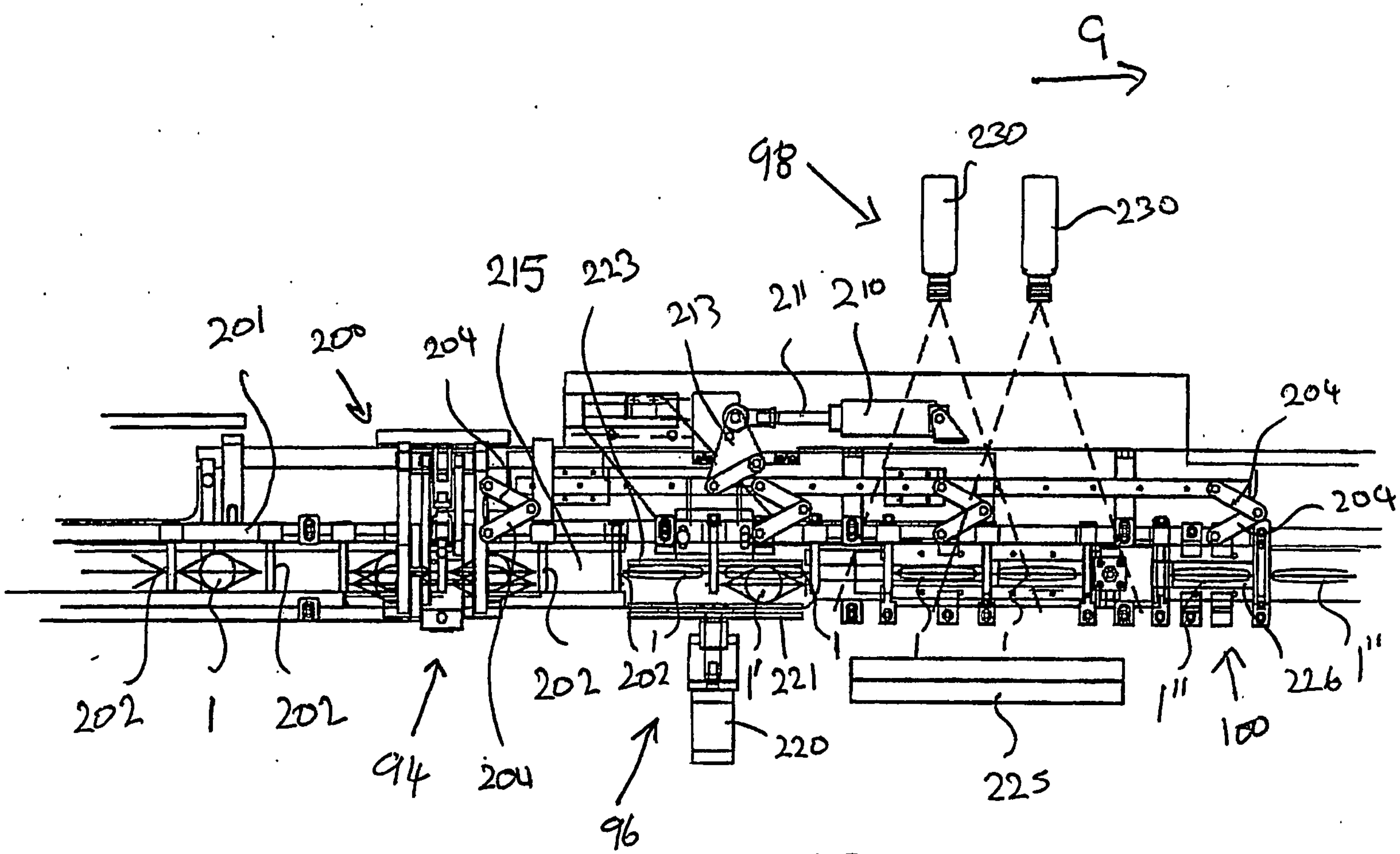
121
123
123a
123
149
123a
123

FIGURE 20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230
215
223
213
211
210
201
200
204
204
204
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1
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94
204
202
202
1'
221
96
220
225
1''
100
226
1''

FIGURE 23

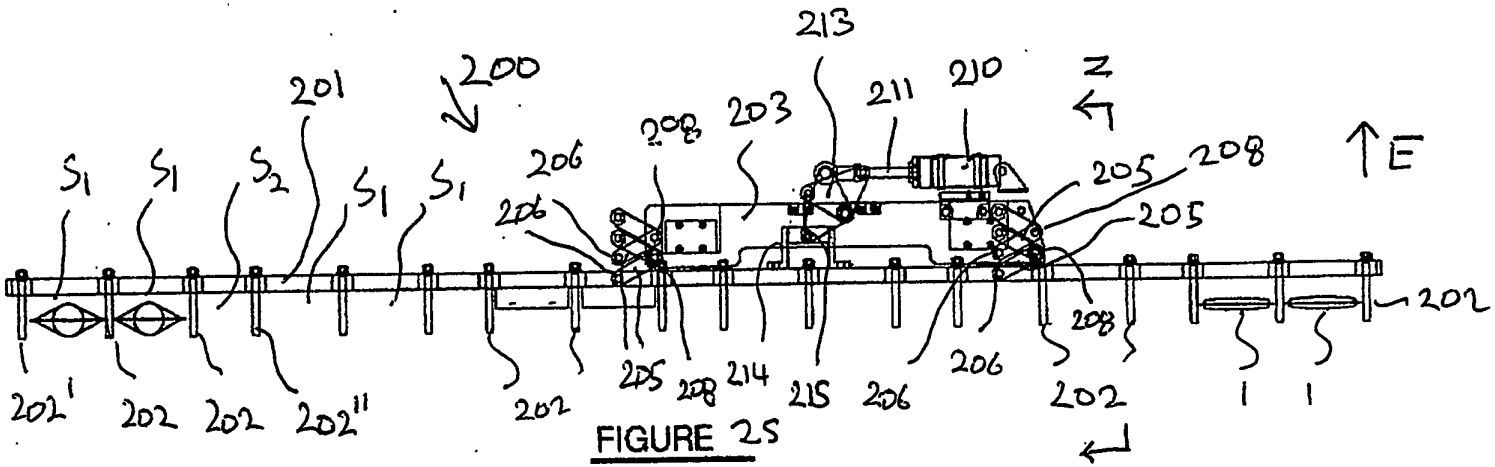


FIGURE 25

25

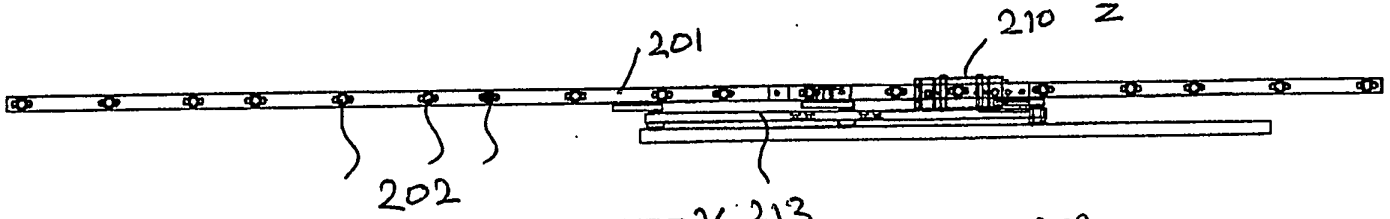


FIGURE 26

26

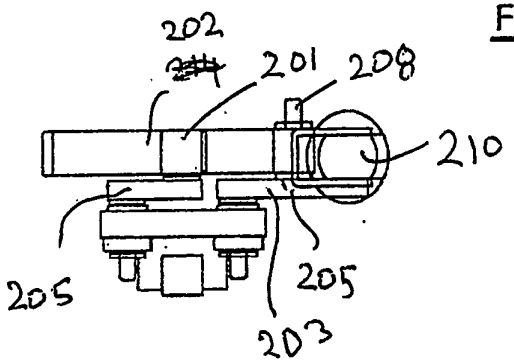


FIGURE 25A

25A

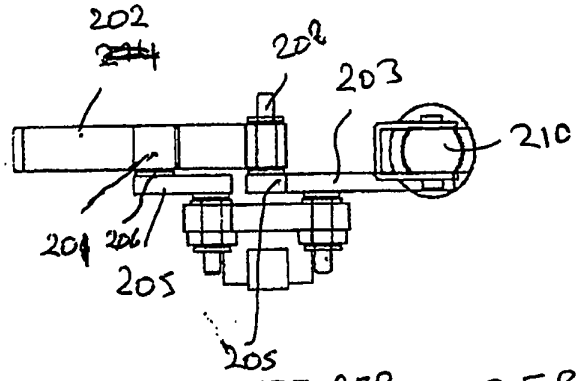


FIGURE 25B

25B

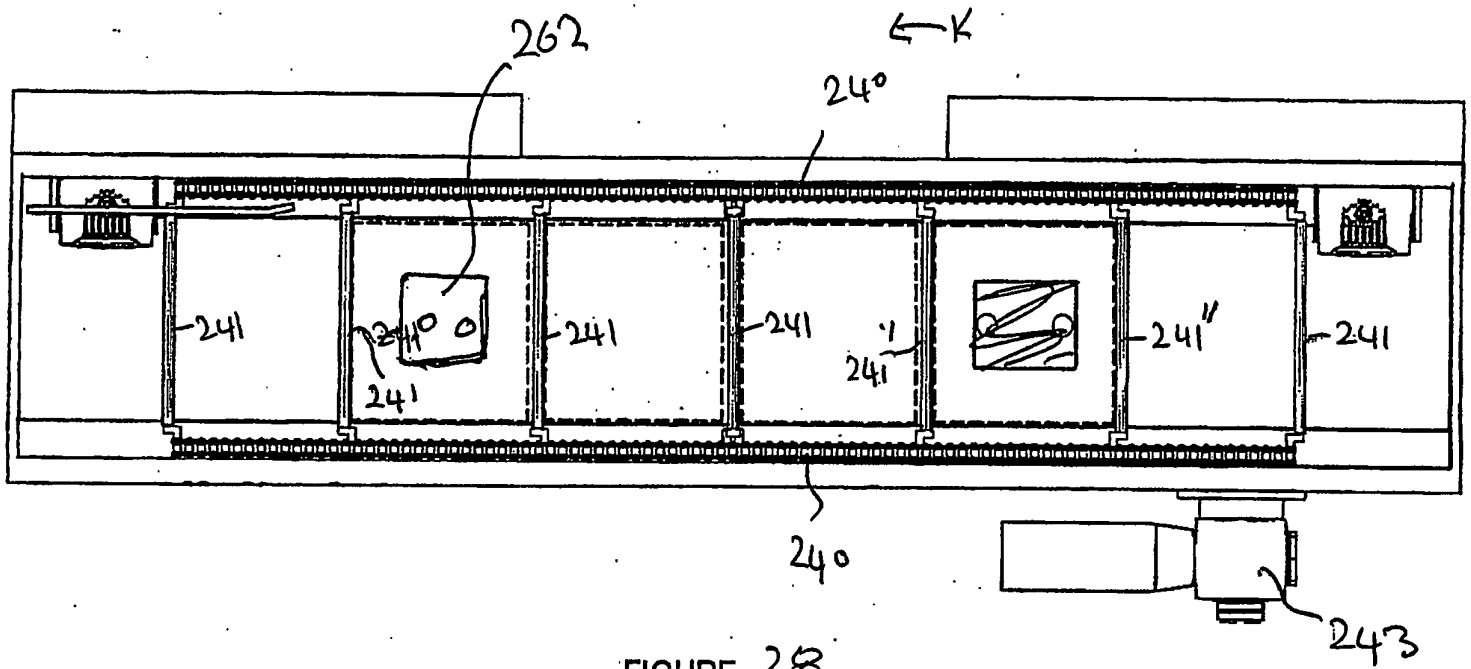


FIGURE 28

~~27~~ 28

~~29~~

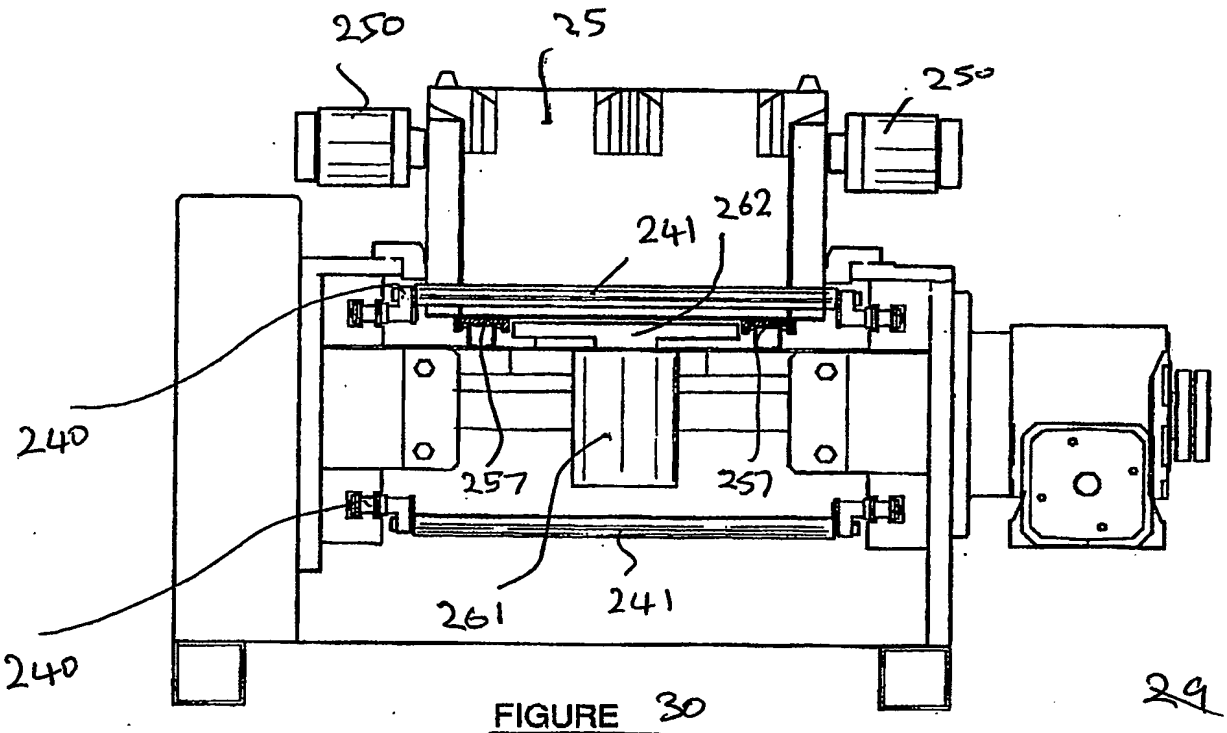


FIGURE 30

29 30

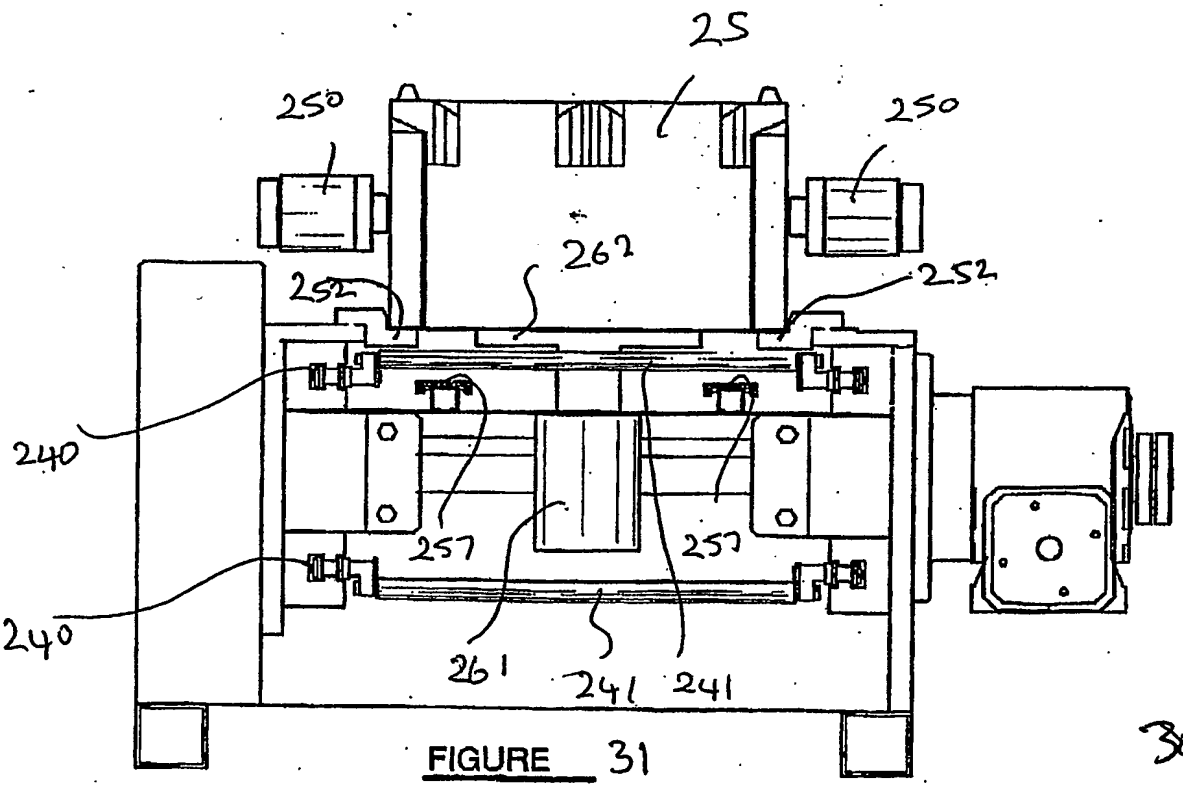


FIGURE 31

30 31

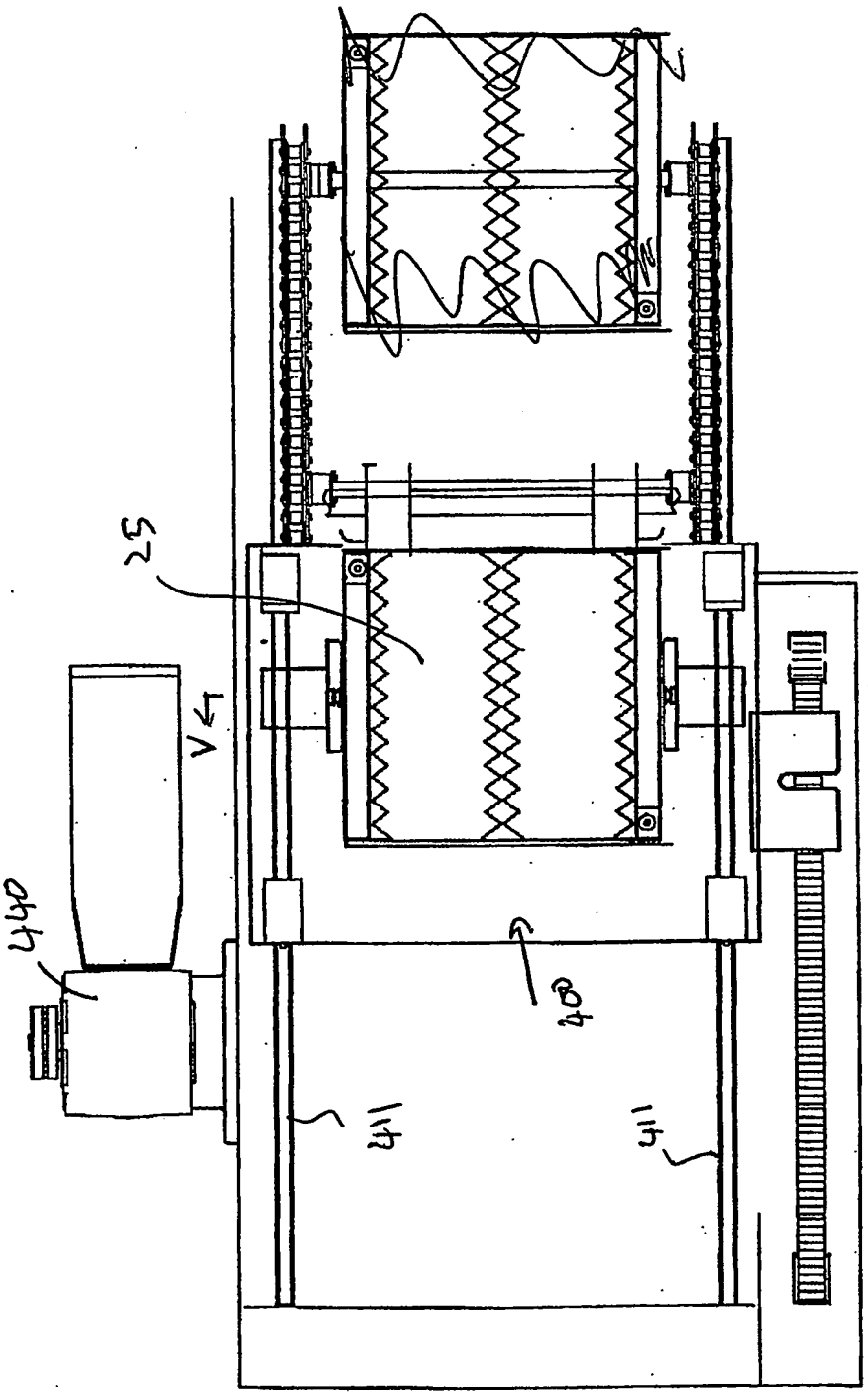


FIGURE 33

FIGURE

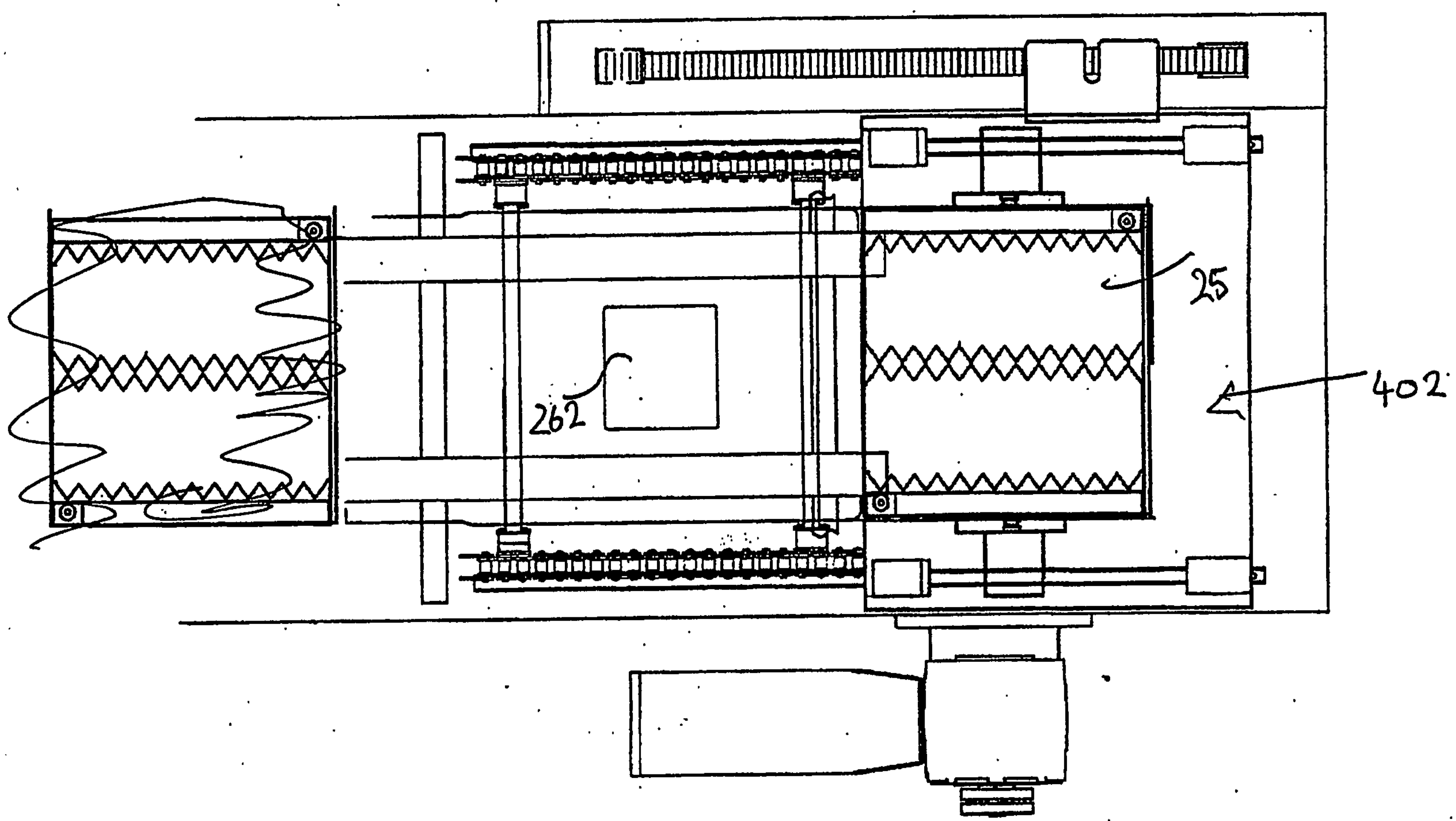


Fig 35

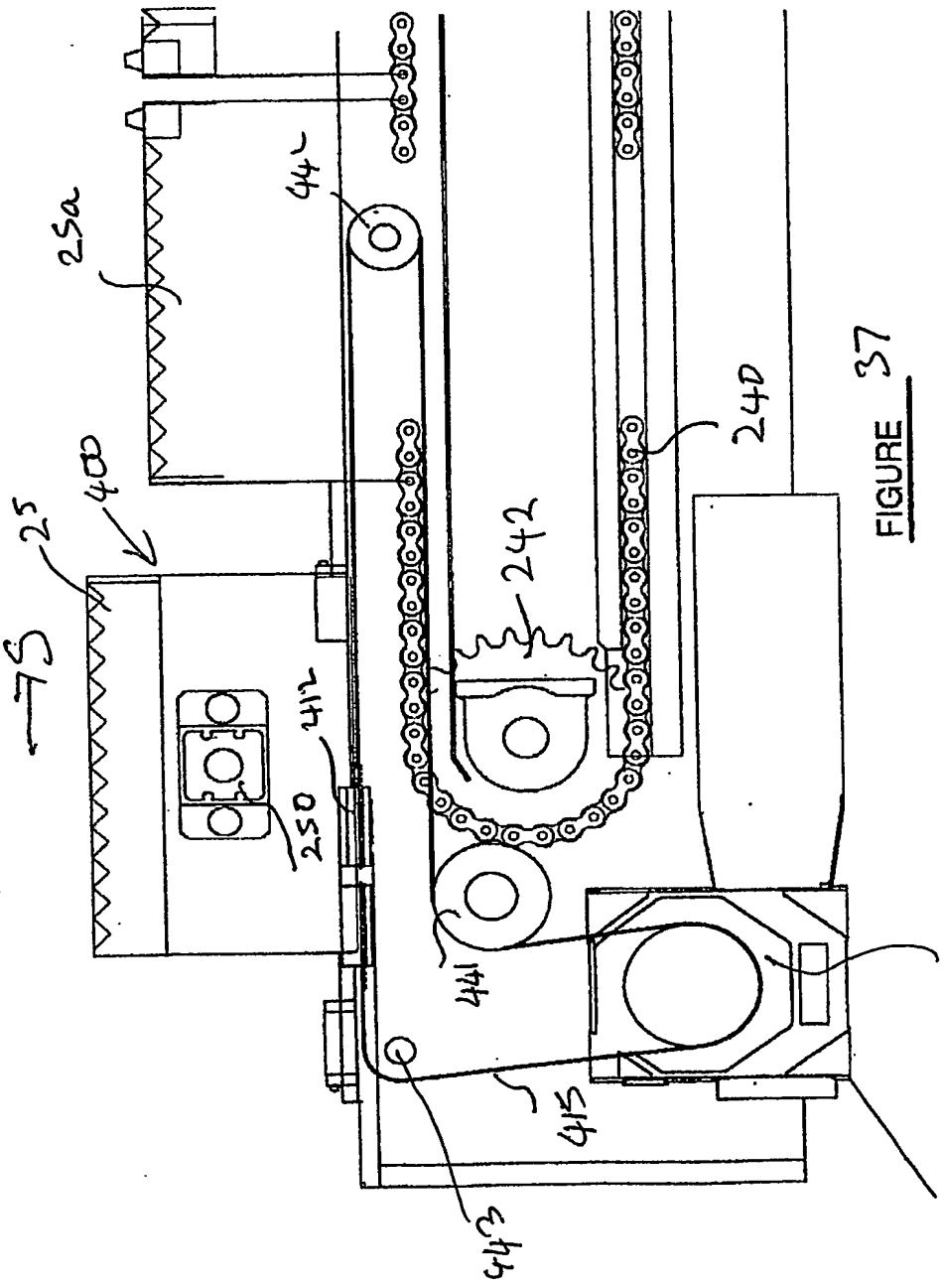
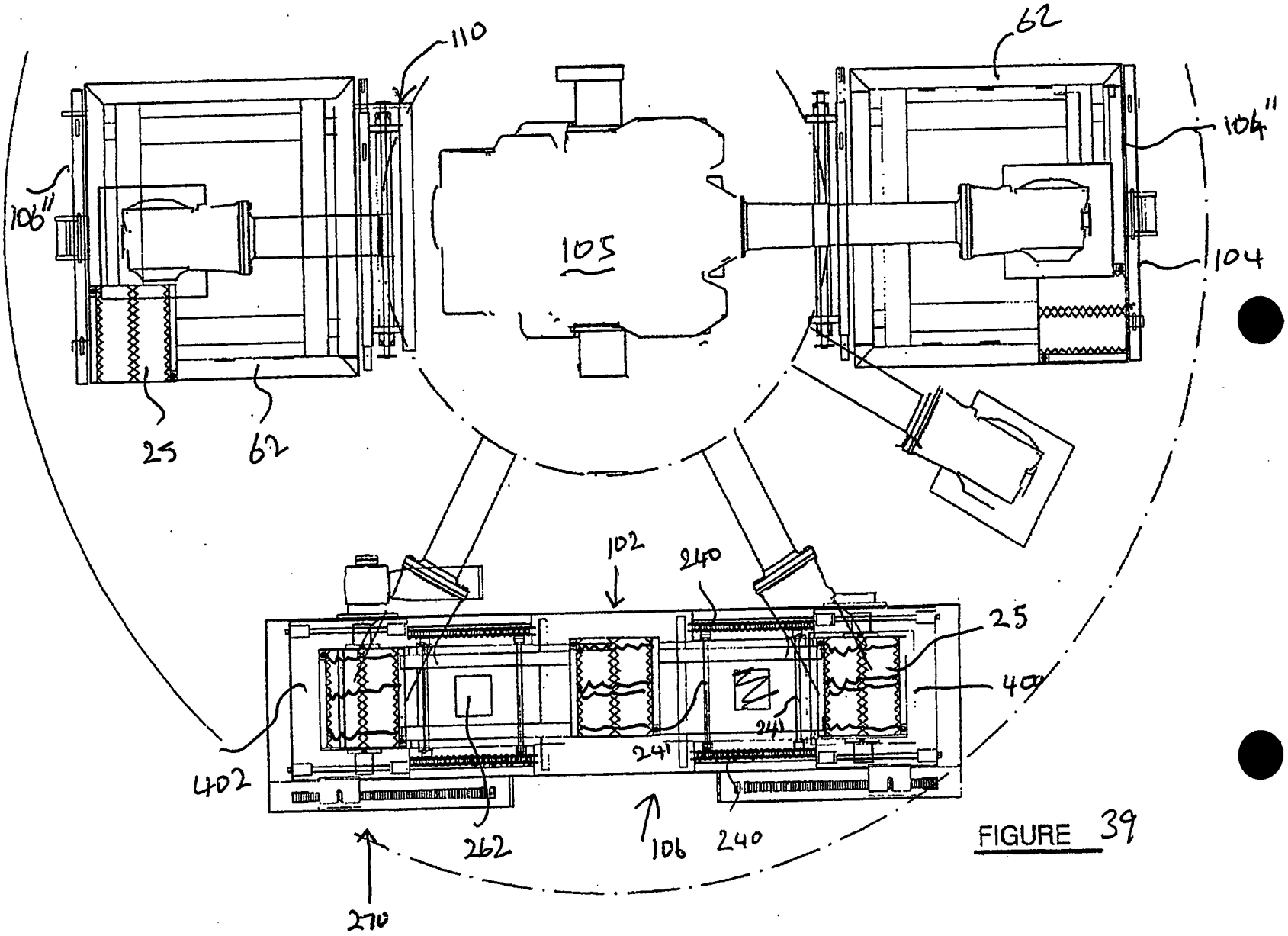


FIGURE 37


110
62
106"
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104"
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270

FIGURE 39

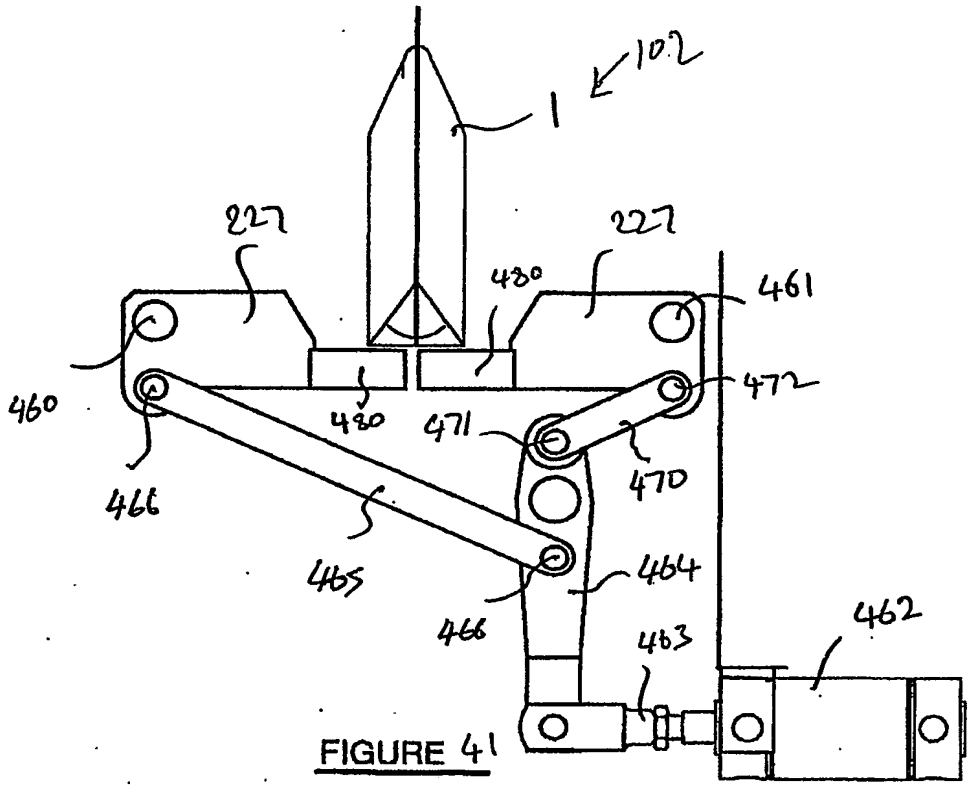

FIGURE 41

41

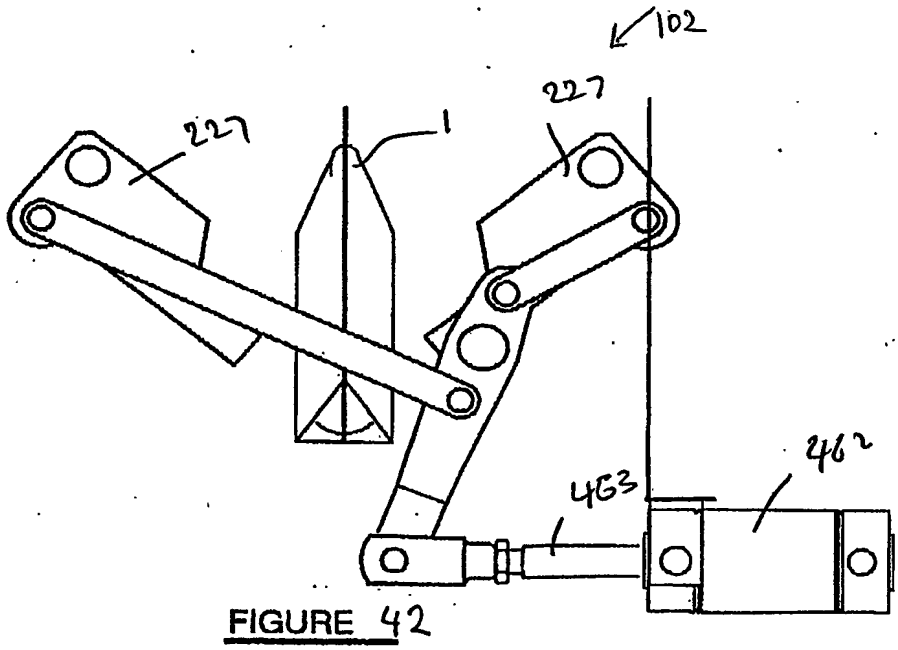

FIGURE 42

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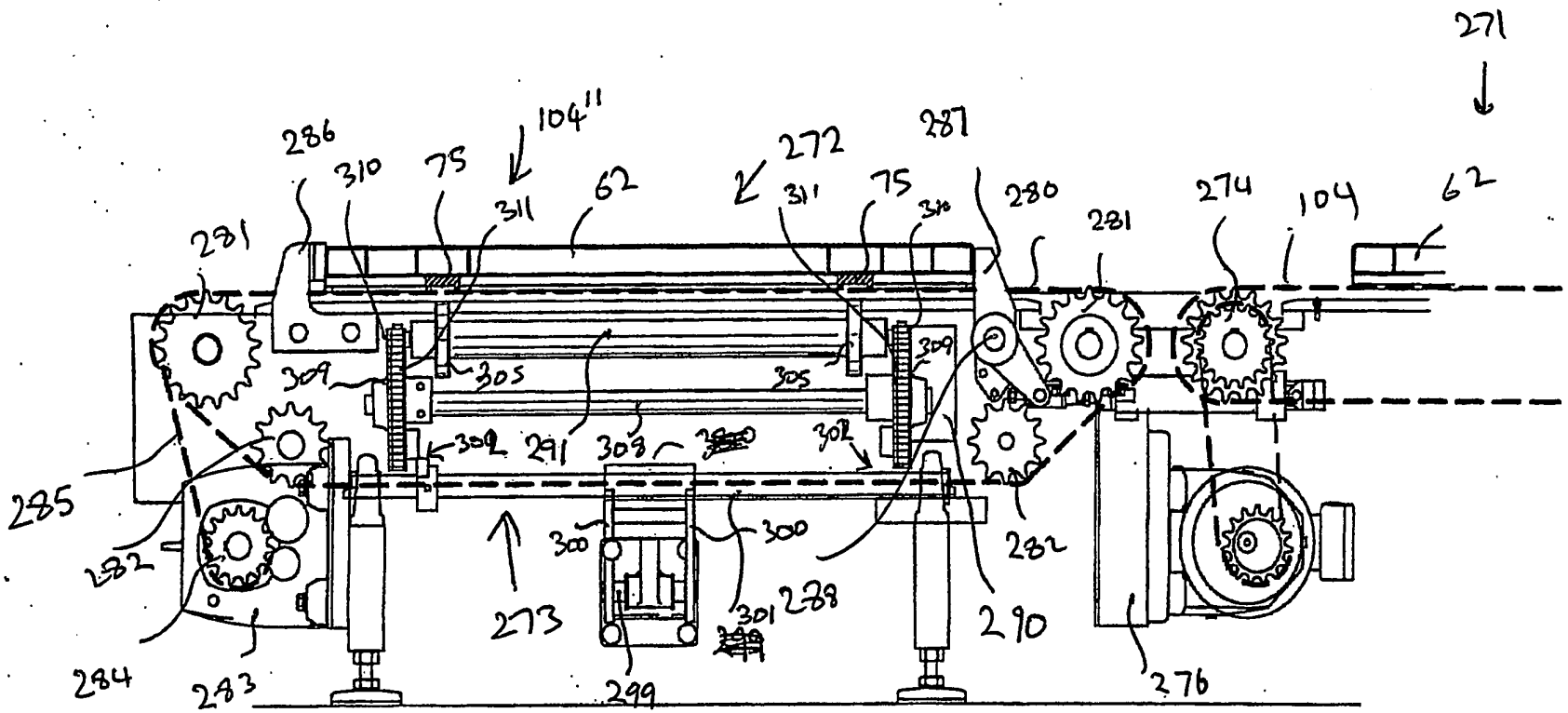
271
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FIGURE 44

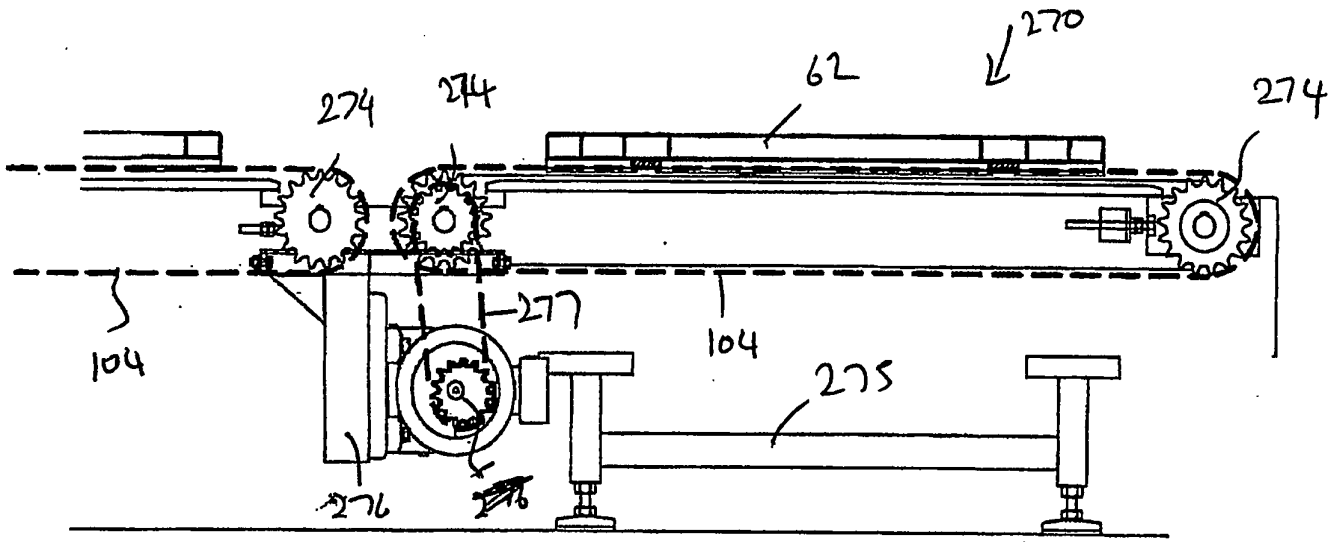

FIGURE 46

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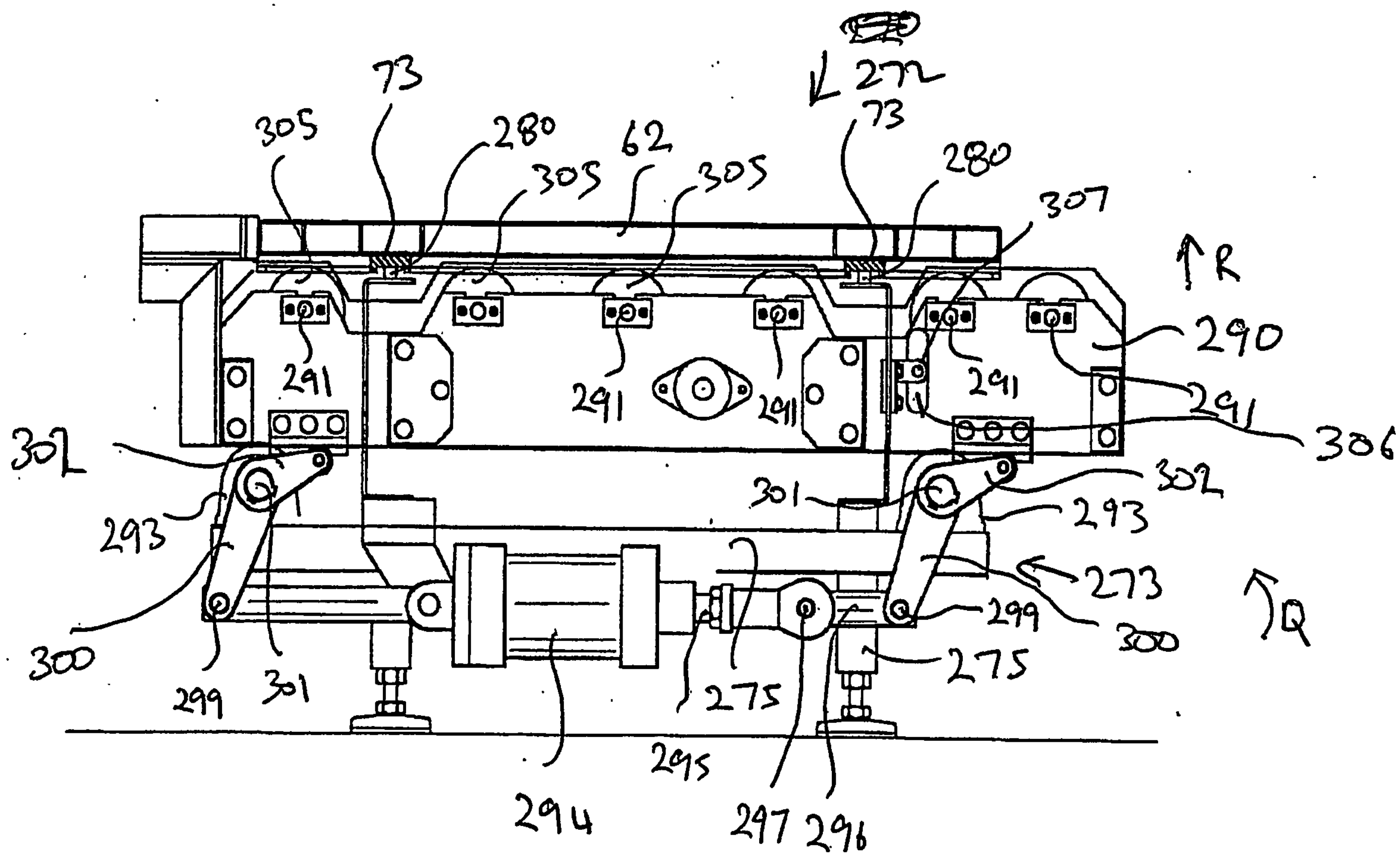

FIGURE 49

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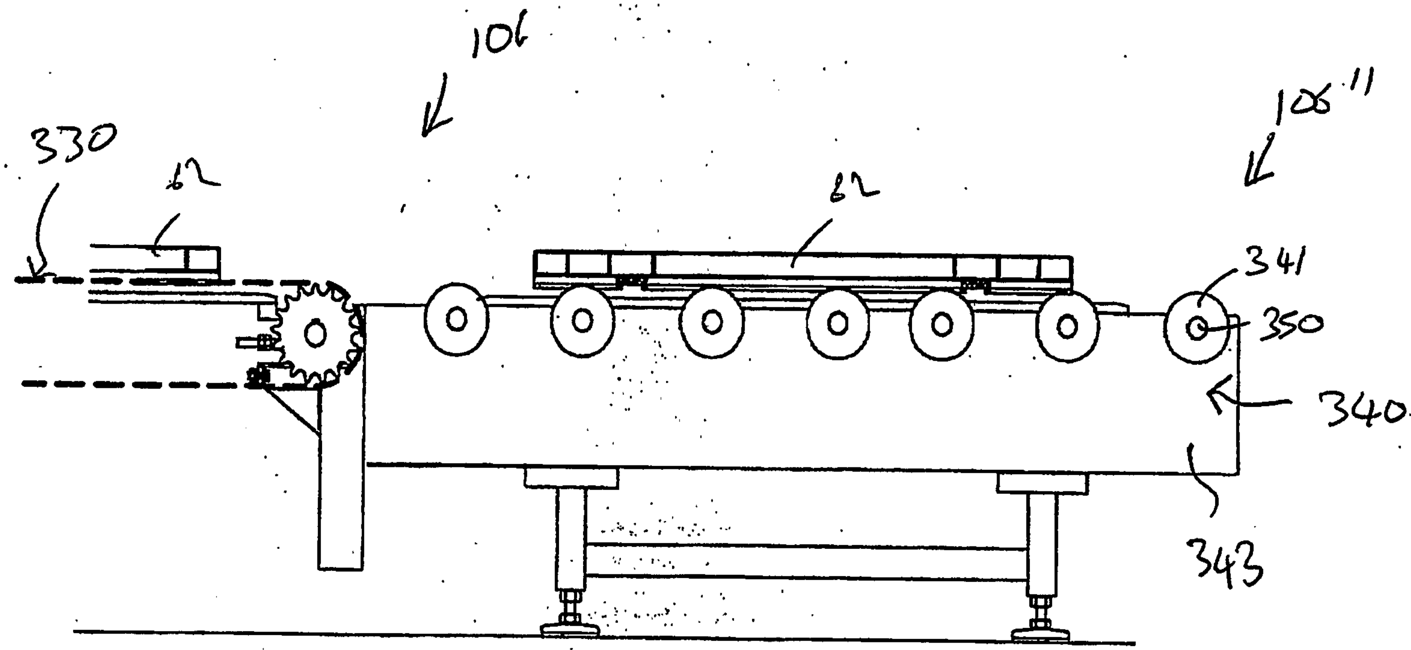

FIGURE 52

~~39~~ ~~51~~ 52
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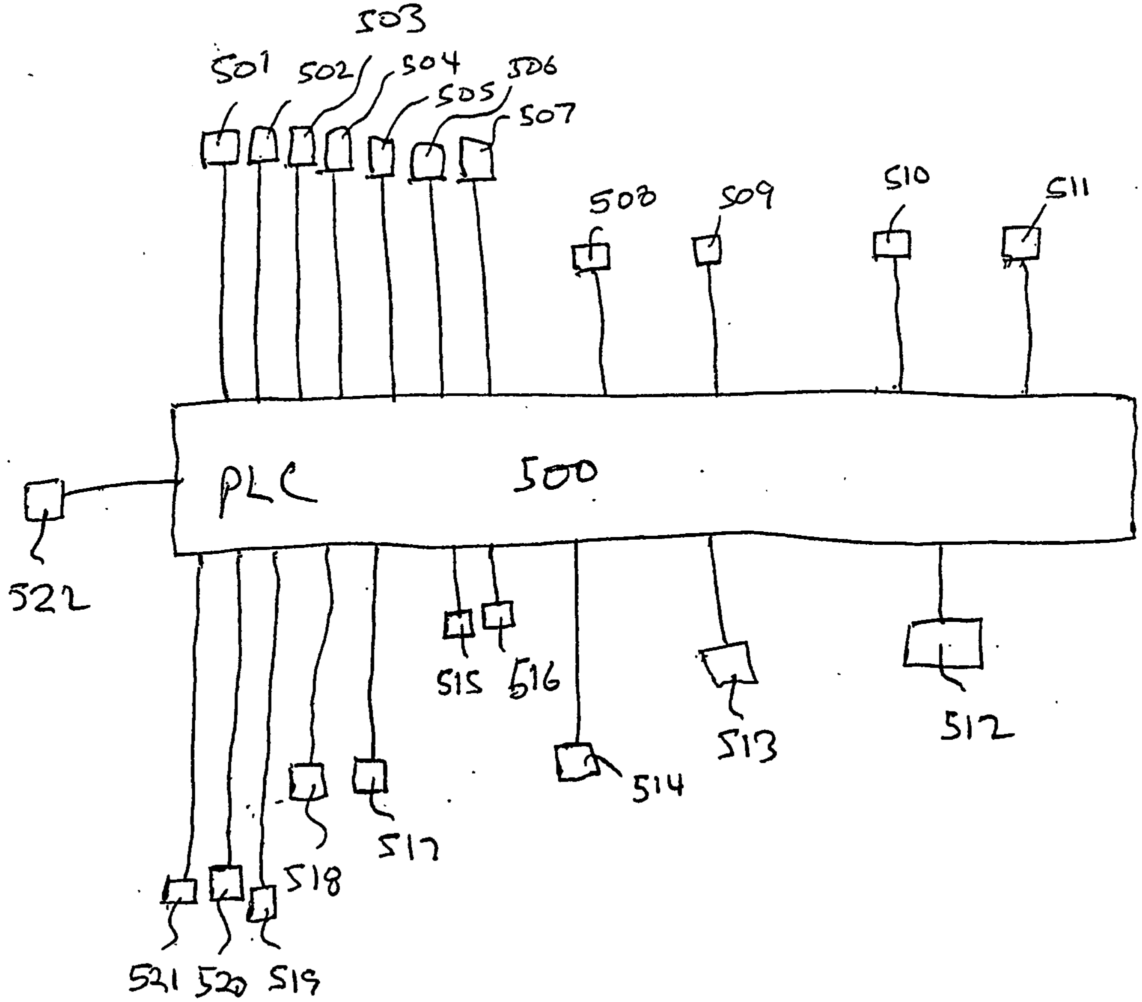
PLC
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Fig 54